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AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

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Columbian Exhibition Notes.

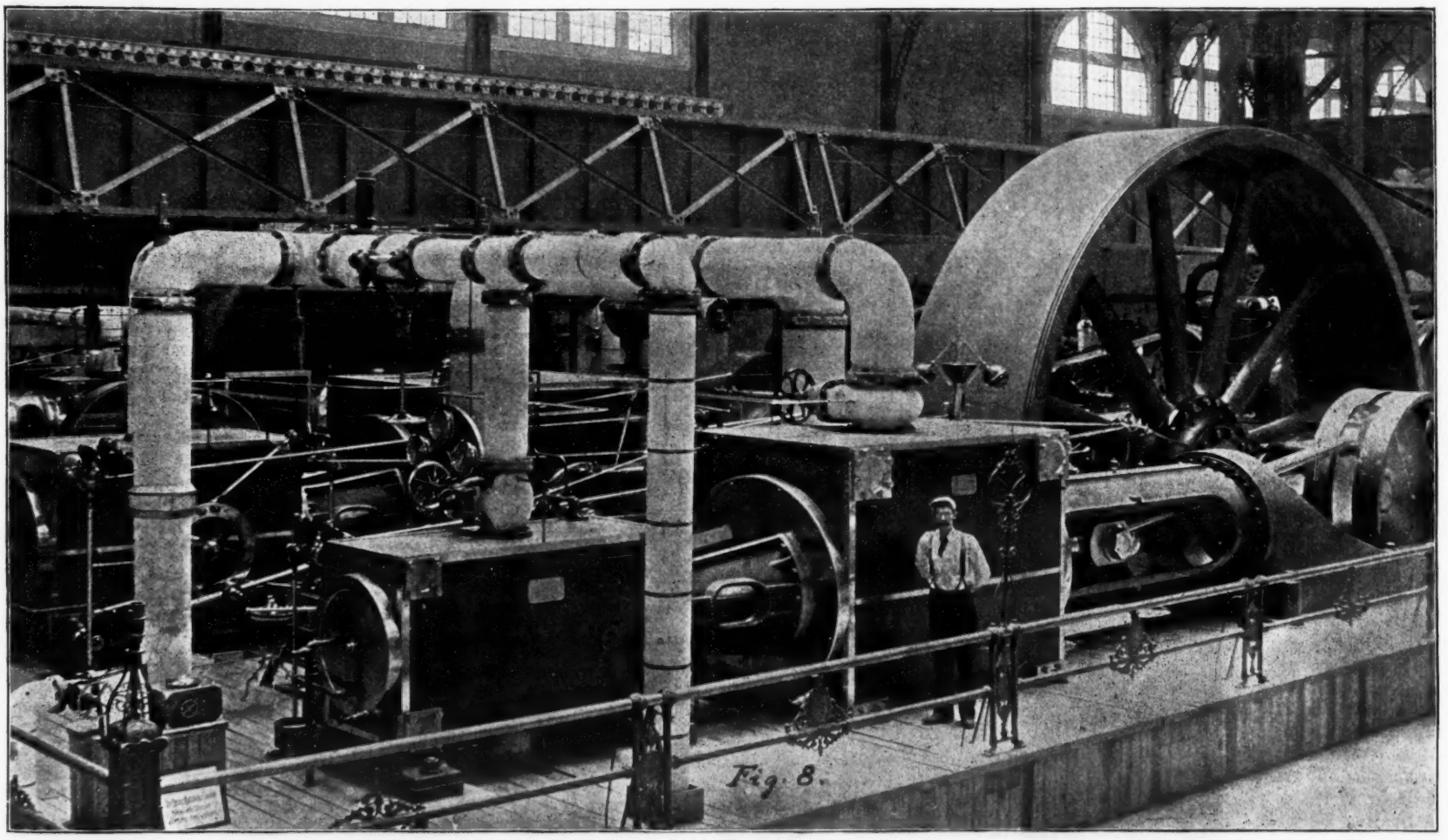
Editorial Correspondence.

THE ALLIS 2,000 HORSE POWER ENGINE.

At Fig. 8 is seen the largest engine here, the one which nearly everybody has read about in connection with the Fair and wants to see the first thing when he enters the Machinery Hall. It is a Reynolds-Corliss and was built by E. P. Allis & Co., of Milwaukee, Wis., and is a quadruple expansion, condensing engine, the initial or high-pressure cylinder being the one nearest the observer in the engraving; the one at the extreme left the first intermediate; the one at the right in front of which one of the engineers is standing, the second intermediate and the one in the background the low-pressure. Each side of this engine is composed of five principal parts aside from the moving parts, these being the two cylinders, the connection between them, that portion of the bed in which the guides are located and the forward portion of the bed in which the main bearings are placed. There is no barring engine here or other means of moving the engine except by steam admitted to the cylinders, but the cranks are 90° apart and provision is made for letting live steam into the first intermediate cylinder in case the right-hand side of the engine happens to be on the center.

The valve motion, though essentially Corliss, embodies a modification of this by means of which the cut-off may be varied by the governor from nothing to eleven-twelfths of the stroke. This will be understood by reference to Figs. 9 and 10 (page 2). Referring to Fig. 9 we have a view of the right-hand side of the engine, the high and the second intermediate cylinders First there is the usual Corliss motion which is derived from an eccentric and transmitted to the wrist-plates in the usual manner as indicated. There is in addition to this a cut-off eccentric to which the eccentric rod h is attached, this giving motion to the rocker-arm shown, to which are attached the two connections $g\ g$, these in turn moving the rocker-arms $f\ f$, to the upper extremities of which are pivoted the triple armed levers or bell-cranks $d\ d$. The horizontal arms of these two levers are attached to a vertical connection to the governor, this connection being by a link which permits the rocking motion of the levers $d\ d$ while at the same time it turns these upon their pivots in the upper ends of the rocker-arms $f\ f$, thus advancing the upper or lower arms of the levers $d\ d$ to vary the cut-off. The connections o, o, o, o running back to the steam valves operate in the manner indicated in Fig. 10, the rocker-arms seen at the rear of the large cylinder, Fig. 9, being merely to reduce the length and consequently the necessary diameter of the connections to the rear cylinder.

Referring now to Fig. 10 we see that the wrist-plate connection operates in the usual way to move the hook E which is detached by the knock-off cam in the usual manner as indicated, this knock-off cam being also upon a knock off lever G seated upon the bonnet in the usual way, but instead of this lever having only a slight motion due solely to the action of the governor, it has a regular motion about the hood which is derived from the cut-off eccentric, the connection o before referred to being attached to the lower end of the lever K which is pivoted at L, there being a second arm to this lever K which is shown at the left of Fig. 10 and carries at its lower extremity a sliding block which engages with a slot in the knock-off lever G. The result of this arrangement is that the knock-off cam is made to travel about the hood in such a manner that it is always near the tripping lever of the hook, and is thus ready to act at any part of the stroke determined by the governor in the manner indicated, and thus greatly extending the range of the cut-off.



ALLIS ENGINE.

The cylinders of this engine are 26 inches, 40 inches, 60 inches and 70 inches diameter; stroke 72 inches, and the speed 60 revolutions The fly-wheel is 30 feet diameter, 76 inches face, and upon it are two belts 6 feet wide, superposed and each driving a Westinghouse 10,000 incandescent light dynamo which are placed tandem. There is a Reynolds independent jet condenser and air-pump, the pump cylinder of which is 36 inches diameter and 16 inches stroke.

The load which can at this time be put onto this engine is really not sufficient to enable it to run properly, and the engineer in charge, after trying for some time to run it with steam throttled down from 115 pounds to 80 pounds, has now disconnected the left-hand side of the engine and blocked the crosshead on that side, so that he can run with the two right-hand cylinders until the dynamos are loaded sufficiently to enable him to run both sides with a fair load. I expect some locomotive man who objects to two-cylinder compound locomotives because the work done on the two sides may not be exactly equal will tell the engineer of this engine that he is ruining it, but my impression is that he knows pretty well what he is about.

THE BUCKEYE ENGINE.

Fig. 7 (page 2) represents the largest and most important Buckeye engine here, made by the Buckeye Engine Company, Salem, Ohio. Its work is driving dynamos, and it runs at a speed of 86 revolutions. I was not able to find out just how much work it is doing here, mainly, I suppose, because its work is not yet fully upon it, the electrical installation being as yet incomplete. The engine is intended, however, to do about 1,500 horse-power, at ordinary pressure. It is a four-cylinder triple expansion, the cylinder furthest from the observer being the high-pressure cylinder, 20 inches diameter; the forward cylinder at the left, the intermediate, 32 inches diameter. The two rear cylinders are the low-pressure, and are both 36 inches diameter; the stroke being 48 inches. The fly-wheel is 20 feet diameter and 72 inches face, the belt being 6 feet wide, of leather, three ply. The cylinders are covered with sheet iron which is nicely planished, and the general appearance of the engine is very neat. There is, however, in it no important departure from the regular Buckeye construction as to valves, governor, etc., except that the high and intermediate cylinders have piston valves. There is on this engine, however, one feature which is new, and is called an assistant valve mover. It consists essentially of a 6-inch cylinder which is bolted to the rear head of the intermediate cylinder, its piston rod being attached to the stem of the main valve of the

low-pressure cylinder. It is provided with an oscillating valve which is moved by a connection with the same main valve stem, so that it acts something in the manner of a direct-acting steam pump, its only office being, however, to relieve the main eccentric of part or perhaps most of its load.

THE GALLOWAYS ENGINE.

One of the engines which attracts most attention and comment here is the one which furnishes power to drive the shafting of the British section, and which is shown in Fig. 5 (page 3). It is built, as the signs shown in the engraving plainly indicate, by Galloways, of Manchester, and running at 70 revolutions with 100 pounds boiler pressure indicates about 350 horsepower. It is a compound, the high-pressure cylinder being placed top of the low-pressure cylinder with the center lines of both cylinders in line with the crank-shaft, the separate connecting rods, one for each cylinder, taking hold of the same wrist-pin, side by side, the lower crosshead guide being within the bed, while that for the upper crosshead is a single bar, as shown, which also serves as a tie between the bed and the upper cylinder by means of the arch bolted to the former as shown. The advantages claimed for this style of construction are economy of room laterally over the cross-compound, and lengthwise over the tandem compound. Besides very short passages are secured from one cylinder to the other.

The engine is condensing, the air pump being shown at the rear of the low-pressure cylinder and operated by a continuation of its piston rod. The working barrel of the air pump is made of gun metal, and is removable so that it can easily be replaced when worn; the working parts of the air pump piston being also of gun metal.

Slide valves are used which are placed at the side of the cylinders, there being a main valve which is moved direct from the eccentric, has a fixed motion, and gives a constant lead, on the back of this being a multiple ported cut-off valve, which, when the governor is not in action, travels with the main valve, but has its motion varied by the action of the governor to control the point of cut off. The governor is high speed, parabolic, the fly-balls being really cylinders or rollers which are hung from above in the usual manner and engage with parabolic slots in the weight, the effect being to increase the resistance of the weight to upward movement as it rises in proportion to the increased centrifugal force of the balls. It is stated that it will run at any height without variation of speed beyond 1.5 to 2 per cent.

At Fig. 6 is a diagram which though made from a hasty sketch and not to scale, is sufficient to show the method of varying the cut-off. At *A* is the eccentric strap, attached to which is the curved link *B*, the eccentric strap and link being kept in position by the connection *C* the lower end of which is pivoted to the bed plate, the result being that the link *B* has a vibrating motion. The valve stem *D* for the low-pressure cylinder is attached directly to the eccentric strap, there being no variation of cut-off for this, and the stem for the main valve of the high-pressure cylinder *E* is also attached direct, the motion of these two valve stems being uniform. At *F* is the stem of the cut-off valve, which is parallel to the main valve stem *E* and side by side with it, but terminates at *G*, where a bell-crank is attached to it, this bell-crank being pivoted to a downward extension of the main valve stem at *H*. The other end of the bell-crank rests in a slide *I* which is always parallel with the valve stems, but is part of the link *J* which is given a motion at right angles to that of the valve stems by means of the bell-crank at its upper end which is pivoted upon the engine frame and is moved by the connection *K*, the amount of motion given to this depending upon the height of the right-hand end of the link *K* within the slot of the eccentric link *B*, this height being controlled by the governor by means of the lever *L* and the connection *M*. It is now evident that if the slide *I* were stationary and in a position opposite the pivot *H* the cut-off valve would have the same movement as that of the main valve, but the motion given to the slide *I* at right angles to the valve stems simply subtracts from the motion of the cut-off valve, and as the amount of motion given to the slide *I* depends upon the height of the governor, more or less motion is subtracted as may be required for the governing function.

The high-pressure cylinder is 17 inches diameter, low-pressure 30 inches diameter and the stroke 45 inches. The fly-wheel is 23 feet diameter, grooved for twelve 1¼-inch ropes, these running onto a pulley which is on a jack-shaft below the floor from which runs a belt to the line shaft above, as shown at the left of the engraving. Inside the rim of the fly-wheel are seen the teeth which are engaged by a pinion which is driven by the barring engine seen on the floor at the extreme left, though partly concealed by one of the supports of the crane runway. There is a feature of this pinion which attracts considerable attention and is certainly very ingenious and well adapted to its purpose. Upon the pinion shaft, which, of course, is parallel with the shaft of the main engine, there are two spiral grooves which are diametrically opposite each other and the pinion instead of being bored with a plain hole is rifled to fit these spiral grooves, the direction of the spiral being such that so long as the fly-wheel is moved by the pinion the latter is forced against a collar on the shaft and retains its place; but as soon as the main engine takes steam and begins to propel itself, the pinion begins to be driven by the teeth on the fly-wheel and at a faster rate than the pinion shaft is being driven by the smaller engine, the result being that the pinion is as it were screwed along on the shaft, away from the fly-wheel, until it is thrown out of gear, the action being thus positive and entirely automatic.

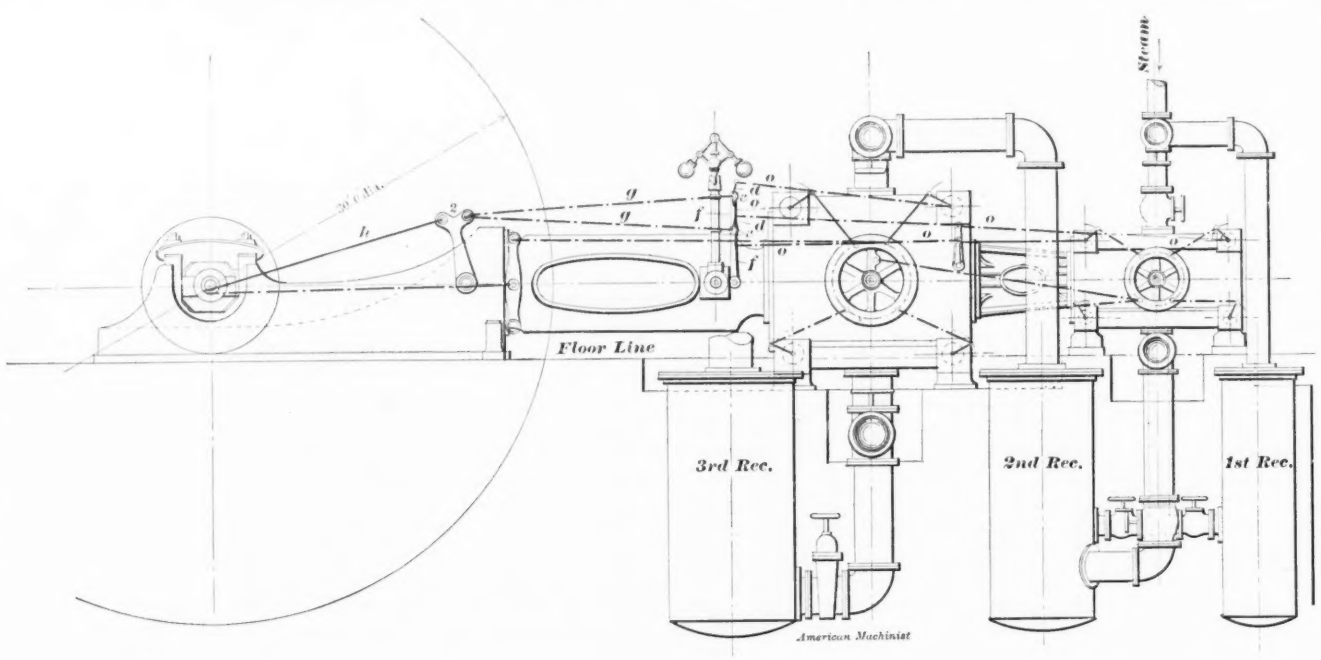


Fig. 9

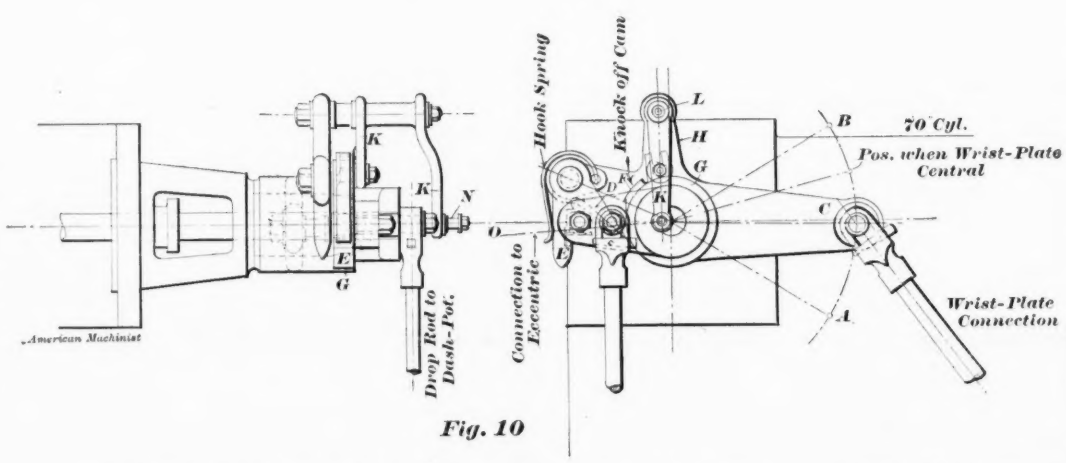
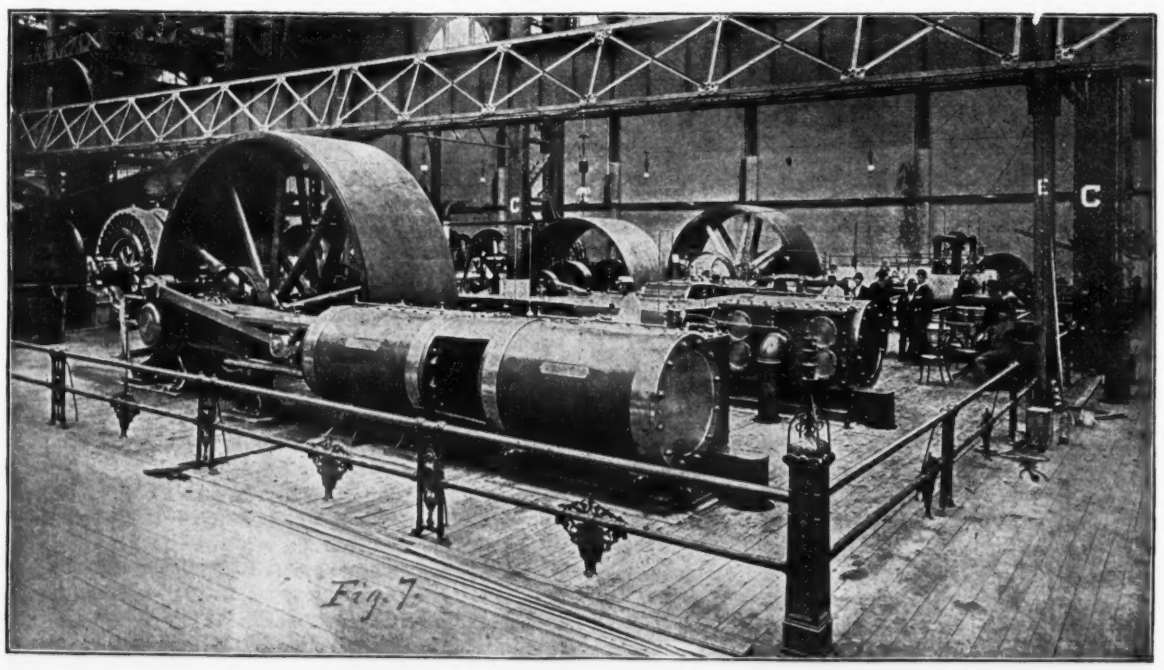


Fig. 10

There are indications that a great proportion of the people who see this engine think the arrangement of cylinders and connecting rods is for the purpose of avoiding the dead center, but as steam can be admitted only to the high-pressure cylinder at starting, there is no advantage in this way, though it is probable that the turning force imparted to the crank after the engine is fairly in motion is more evenly distributed through the revolution than can be done with any single tandem compound engine. As to the design, I need say nothing, since the engraving shows it plainly. It is thoroughly English, looks as though it were constructed solely for business, and so far as can be judged from a superficial examination, the work upon it is well done, which is further indicated by the fact that the engine runs very smoothly and quietly



BUCKEYE ENGINE.

At this writing the subject of paint is exciting considerable interest among the engine men. It seems that the management has made a rule that all engines shall be painted white and a number of the smaller ones are so painted. But other builders are protesting against this on the ground that white is not well adapted for an engine, a contention that seems borne out by the fact that all those parts of the white engines that are subjected to heat rapidly become yellow and the oil running over the white paint becomes disagreeably conspicuous. Most of the engines have the dark blue color which has become the standard color for machinery and they seem

to a machine man to look much better than those which are supposed to be white. Not only are the painted parts looking better but the finished parts as well. I am informed that one prominent builder who has adopted a certain color as his trademark, so to speak, and naturally prefers it, declared to an official of the Fair that he would have his color on his engine or he would take out the engine. He was informed that he would not take the engine out, but that if he did not propose to abide by the rules laid down by the authorities his engine might stand in its place during the summer without steam "as a monument to his folly." There seems to be some prospect of a battle royal on this question, and what the issue will be is yet a problem.

Jackson Park, June 5. F. J. M.

The Air Hoists at the Armour Packing House.

BY C. A. BURTON.

I have read, with a great deal of interest, the article by Frank Richards, in your issue of April 27th, in connection with pneumatic machinery, and I notice his mentioning the Armour Packing Co., of Kansas City, Mo., who are using a large number of pneumatic hoists in their extensive packing house in this city. In connection with this fact, I thought a slight description, together with a print, which is herewith sent you, would not be out of the way, and might interest many readers of your valuable journal.

These hoists were built by the Keystone Iron Works Co., of this city [Kansas City, Mo.], and range in size from 8" cylinders to 24", and in length of stroke from 28" to 16 feet. These hoists are used in the packing house in the killing rooms and cutting floors, and as droppers and as elevators; the first operation on the cattle is to raise the gates after the cattle are killed, and to throw the body into the cutting room; then the next operation is the hoisting of the cattle during the process of removing their hides and dressing the carcass, and finally for dropping the carcass on to suitable tracks or runways before running same into the cooler.

You will notice the cylinders have heads on both ends, the stuffing box on the front end. The cylinder heads are put on both ends for the purpose of introducing air in the back end in case anything should stick or refuse to work about the hoists. The piston pulls the load rather than pushes it, bringing to bear upon the piston head a tension strain. These hoists are built for various amounts of lifts, the amount of lifting being either increased or decreased by introducing more or less sheaves. These hoists work under an air pressure of from 80 pounds to 125 pounds, and are found to work very satisfactorily.

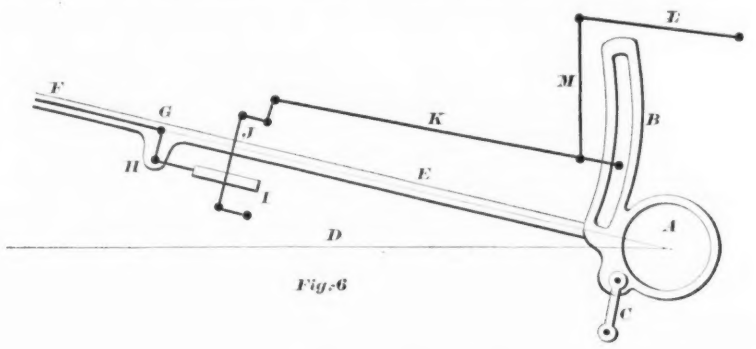


Fig. 6

The piston rod is $1\frac{1}{16}$" diameter, of cold-rolled steel; the sheaves are cast iron turned in the groove, running on 2" cold-rolled shafting. The connection between the cylinder and the front sheaves are two pieces of gas pipe; these gas pipes form the slides over which the crosshead moves. The lowering down of the load is generally performed by gravity.

The hoisting is produced by admission of air to the front of piston, which pressure pulls the load up. The pistons are of cast-iron with metallic packing, of which the drawing gives a very good idea. The cylinders are bored carefully and counterbored. The inlet pipes are 1½", and the admission and discharge of the air is handled by means of four way valves. These valves were found to be difficult to design and to make satisfactory, but Mr. James Smith, General Superintendent of the Keystone Iron Works, was successful in making a valve that has proved very satisfactory.

The compressor supplying the air to these hoists is located a long distance from the hoists near the steam plant, and suitable pipes convey the air to the hoisting plant The absence of line shafting, pulleys, frictions, etc., and the noiseless working of these hoists make them every way the most satisfactory of lifting machines yet introduced for that purpose.

They use ¼" pliable hoisting cable with suitable connection for the several classes of work for which these hoists are intended. The simplicity and cheapness with which these are built and maintained, are certainly commendatory, and their reliability and the small amount of repairs makes these hoists and their maintenance a matter of very small cost. This plant of hoisting machinery is the first, and the house mentioned is the only packing house in the country equipped with this kind of machinery. This system of compressed air hoists is extended to elevators having 24" cylinders, with sheaves to give a hoist of six stories, and to operate elevators with a carrying capacity of 6,000 pounds.

It seems to me that this class of hoisting machinery could and should be more thoroughly put into practical use for the many purposes hoisting machinery is used for in these days. This particular machine was designed by the writer, and has, so far, proven very satisfactory. To any one interested in the question of compressed air hoists, it would be well worth their while to visit this plant.

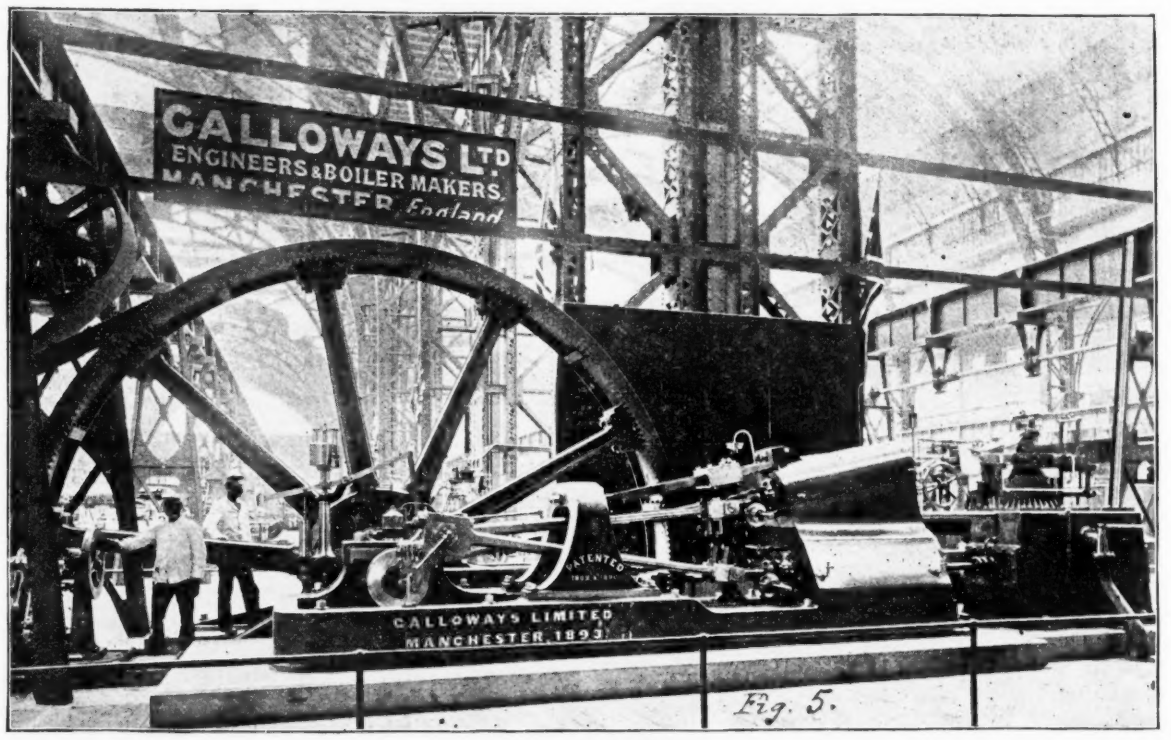
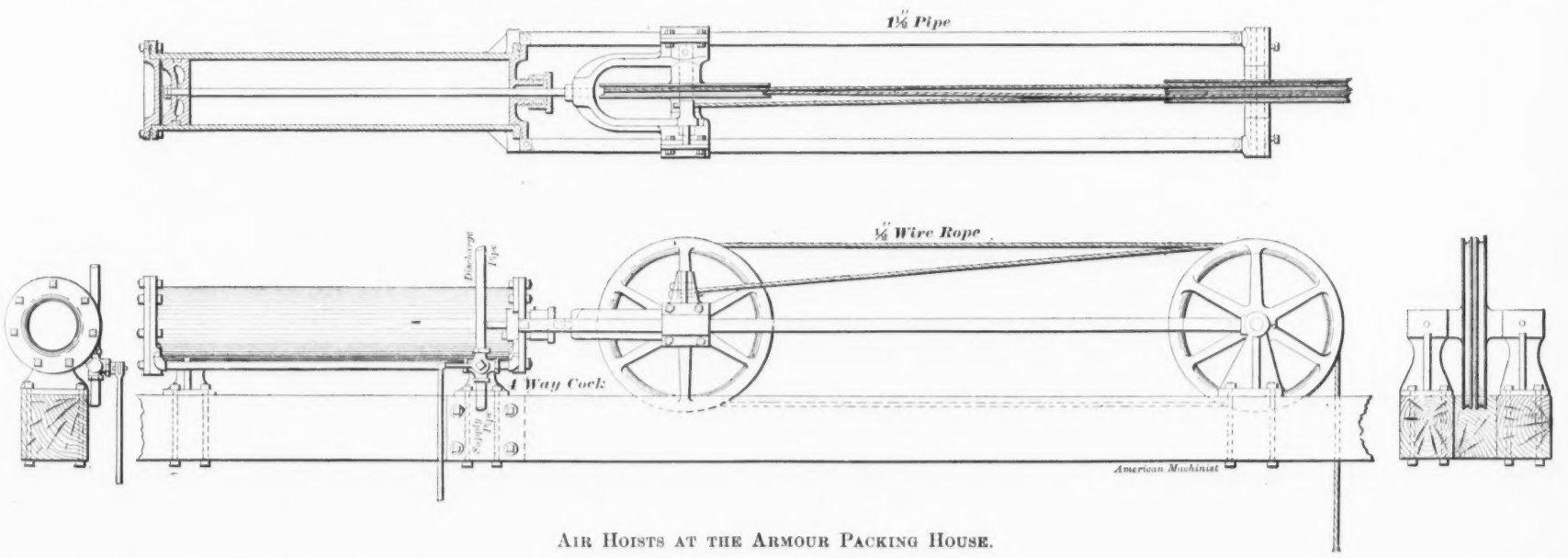


Fig. 5.

GALLOWAYS ENGINE.



AIR HOISTS AT THE ARMOUR PACKING HOUSE.

There was considerable trouble at the Paris Exposition with the giving out of steam pipes; quite as much, we think more, than there has been at Chicago.

A T-square designed by Mr. H. Rickinson, of London, is channeled the whole length of the underside of the blade, with the avowed object of preventing the soiling of the paper.

It is said that a French inventor puts leather or hides for belts through some sort of process similar to that of making parchment, instead of tanning, the result being a much better belt that will not stretch.

Mr. George Cawley has retired from the chief editorship of our English contemporary, *Industries*, and has taken rooms at 29 Great George street, Westminster S. W., where he will carry on the business of consulting engineer.

Sibley College Tools.

In our issue of March 9 we published a letter from Dr. Thurston, of Sibley College, in relation to some lathe tools and chisels forged by a student, which had been sent to us, and about which we had made some remarks. In his letter Dr. Thurston asked that we hand the tools to some one competent to give them a trial and report upon them. We handed the tools to Mr. James Brady, of Brady Mfg. Co., and have received them back with the following:

REPORT ON LATHE TOOLS RECEIVED FROM AMERICAN MACHINIST.

DIAMOND POINTS.—Shapes not good, too much rake both front and sides. Right-hand tool broke taking ¼ inch cut from piece of machine steel 3¾ inches diameter at a cutting speed of 18 feet per minute.

SIDE TOOLS.—Shapes very good; gave general satisfaction.

ROUND-NOSE TOOL, DIAMOND POINT

FORM.—This tool is possessed of the same defects as the diamond points, making it altogether too weak for the uses it could be put to.

STRAIGHT ROUND-NOSE TOOL.—Shape good.

PARTING TOOLS.—These tools were not finished quite carefully enough, requiring considerable grinding on sides for clearance.

BORING TOOL.—The cutting lip of this tool was drawn up too high, preventing as wide a range of usefulness as a tool of its size should have.

CENTERING TOOL.—Answers its purpose well.

BROAD NOSE TOOL.—Answers its purpose well.

FLAT CHISEL.—This tool had a good shape but was not properly forged. The cutting edge had several cold shuts in it, and naturally the tool broke as soon as used.

CAPE CHISEL.—Shape good, but the steel was burned in the forging.

WM. H. PIKE, Sup't.
BRADY MFG. CO.

The Centrifugal Pumping Plant at Mare Island Navy Yard.

BY JOHN H. COOPER, M. E.

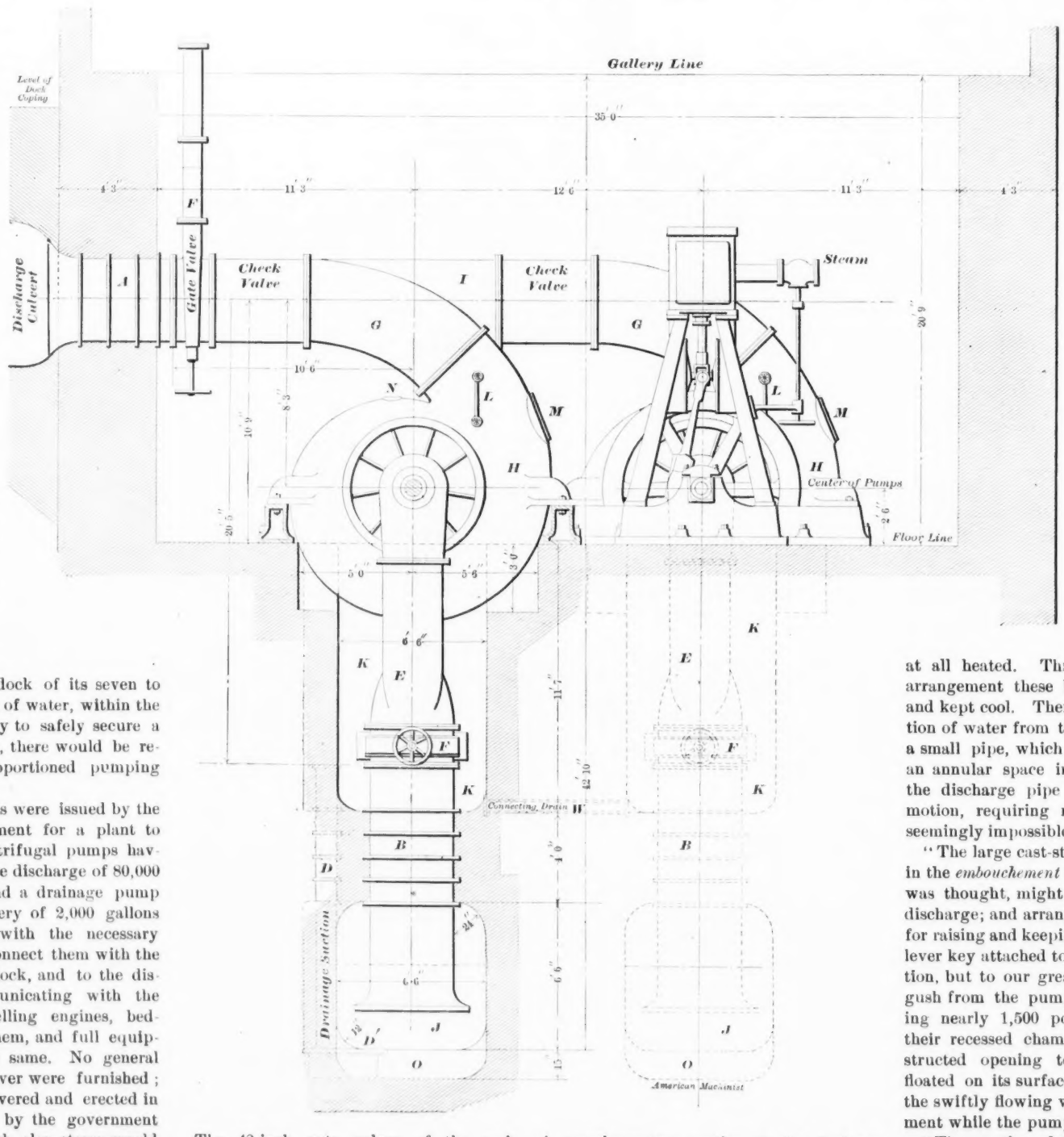
A marked departure in centrifugal pump building in this country was inaugurated in the year 1884. During this year an example of superb stone dock architecture was nearing completion at Mare Island Navy Yard, near San Francisco.

For emptying this dock of its seven to nine millions of gallons of water, within the limit of time necessary to safely secure a vessel within the same, there would be required a suitably proportioned pumping mechanism.

To this end proposals were issued by the United States Government for a plant to consist of a pair of centrifugal pumps having an aggregate average discharge of 80,000 gallons per minute, and a drainage pump with an average delivery of 2,000 gallons per minute, together with the necessary pipes and valves to connect them with the suction wells of the dock, and to the discharge culvert communicating with the river, including propelling engines, bedplates for supporting them, and full equipment for operating the same. No general plans or details whatever were furnished; the plant was to be delivered and erected in a house to be prepared by the government beside the dock, to which, also, steam would be conveyed from boilers furnished by the department. When completely erected by the contractors, the plant was to be tested by a committee of experts appointed by the commandant of the yard.

This contract was awarded to the Southwark Foundry and Machine Company, of Philadelphia, and bears date July 31, 1884, during the term of Mr. Joseph L. Ferrel's management, and to the writer of this article was entrusted the entire formulation of the design, and the conception and arrangement of its details, in which latter he was ably assisted by Mr. T. H. Mirkil, Jr., who also erected and started the plant.

Referring now to a general end elevation of the plant, as designed and erected for this dock, the main pumps *H H* will be noticed on foundation plates located considerably below the dock coping. From the pump centers 30-inch diameter breeches pipes *E E* descend to their joinings, with the horizontal 42-inch gate valves *F F* in their pits below the engine room floor. Extending beneath these will be seen the 42-inch suction pipes *B B*, surrounded by flanges built in the deep concrete arches covering the suction conduits *J J*. Through these conduits all the water from the dock flows into the suction pipes to facilitate which the depressions *O O* were made immediately beneath their bell-mouth inlets. From the discharge ends of the pump casings the water is conveyed through the rising bends *G G* to the check valves, thence through the vertical 42-inch gate valves *F F* into the discharge pipes *A A*, which are built into the heavy walls of the engine house, thence into the discharge conduit below the ground level, which receives the water from all the pumps, and conducts it to the river.



The 42-inch gate valves of the main pumps are steam actuated, hydraulic controlled, and are under the full command of the engineer at his stand by the throttle valves of the engines. They are also provided with starting screws turned by large hand wheels to free the valves from their seats, to which they are liable to stick after long standing. The check valves are supplied with visible index and supporting levers; they float upon the full stream of unobstructed water in their casings, flowing from their pumps when in normal action.

Each engine is directly connected to its own pump, but is independent of the other. The main pumps and engines are mounted upon attached bed-plates, as one firmly united and self-contained whole. The steam cylinders of the main engines are 28 inches diameter by 24 inches stroke; the drainage engine cylinder is 12 inches diameter by 10 inches stroke, these sizes being based upon the promised 50 pounds of steam per square inch. The steam and manipulative equipment includes water gauges *L L* on the sides of the pump casings, steam charging ejectors on the summits *N* of the same, hand-adjusting steam cut-off valves, and the usual automatic oilers, ladders into and foot-plates over the pits, manholes *M M* for access to interiors, etc.

The pumping head of the main pumps varies from nothing at the start to about 35 feet at the finish. The drainage pump being used only for freeing the emptied dock of ordinary leakage, does all its work under the extreme head named, varying only from this by fluctations of the tide without the dock, and by changes of water level within the same.

Its suction pipe *D* is shown in place rising from the pump box *D'* covered by a grating at lowest level of the inlets *J J*. A supplementary suction to the drainage pump relieves the pits *K K* of leakage, the two having a connecting drain pipe *W*.

In order to properly present the results of this initial dock centrifugal pumping plant, some fitting paragraphs are here given from the report of the Chief of the Bureau of Yards and Docks, on the occasion of its completion and first trial. To these may appropriately be added the words of the Board on the full accepted figures of the trials:

"During a pumping period of fifty five minutes the dock had been emptied from the twenty-third to two inches above the sixth altar, containing 6,210,698 gallons, an average throughout of 112,922 gallons per minute. At one time, when the revolutions were increased to 160 per minute, the discharge was 137,797 gallons per minute; this is almost a river, and is hardly conceivable. After the pumps were stopped, on this occasion tests were made with each in succession as to the power of the injectors with which each is fitted to recharge the pumps."

"In practice it would be impossible to secure a vessel in the dock, so rapidly was the water removed at the time of trial, and it is without parallel in the world that so large a dock, with its 7,000,000 gallons of water, has been emptied in fifty-five minutes, and it is almost beyond belief. One pump will do all that is required to empty the dock in use, and then it will require sharp work to properly shore the vessel to replace the rapidly receding water."

"Everything moved most admirably, and the performance of these immense machines was almost startling. By watching the water in the dock it could be seen to lower bodily, and so rapidly that it could be detected by the eye without reference to any fixed point."

"The operation of this vast machinery was highly satisfactory. I went on several occasions down in the valve pits on the ladder of the casing, and to all accessible parts while in motion at its highest speed, and there was no undue vibration, only a uniform murmur of well-balanced parts, and the peculiar clash of the water against the sides of the casing as its velocity was checked by the blank spaces in the runner. To this part I gave close attention, and there was nothing that the ear could detect to indicate aught but the nicest adjustment. The bearings of the runners worked with great smoothness, and did not become at all heated. Through a simple, novel arrangement these bearings are lubricated and kept cool. There is a constant circulation of water from the pumps by means of a small pipe, which completes a circuit to an annular space in the bearings back to the discharge pipe while the pump is in motion, requiring no oil, and making it seemingly impossible to heat these bearings.

"The large cast-steel check valves placed in the *embouchement* of the pump casing, it was thought, might act to check the free discharge; and arrangements were provided for raising and keeping them open by a long lever key attached to their axes of revolution, but to our great surprise, at the first gush from the pumps, these valves, weighing nearly 1,500 pounds, were lifted into their recessed chambers, giving an unobstructed opening to the flow, and they floated on its surface unsupported, save by the swiftly flowing water, without a movement while the pump was in operation."

"The erection of this massive machinery has been admirably done; the parts, as sent from the shops of the contractor, have matched in all cases without interference here, and, when lowered into place, its final adjustment was then made without the use of chisel or file, and has never been touched since."

"All the parts are strong, and of excellent design and workmanship, simple, and without ornamentation. Looking down upon them from level of the pump house gallery, they are impressive and massive in their simplicity."

"The government is well worthy of congratulation in possessing the largest pumping machinery of this type, and of the greatest capacity in the world, and the contractors have reason to be proud of their work."

"There is nothing that a thorough trial has found wanting, or that a careful retrospection suggests. It is ready for the purposes intended at any moment, so far as

pertains to this department, and it is with a feeling of profound gratitude that I am enabled to make this announcement to the Bureau."

"In addition to the two 42-inch pumps for emptying the greatest bulk of water from the dock, an 8-inch centrifugal pump was furnished by the contractors for completing the discharge, and for continuously removing the water of infiltration, which, though small in quantity, must be removed, in order that its accumulation may not cover the floor of the dock, and interfere with the operations of the workman.

"In order to test this pump, the large gates in the drainage tunnels near the invent were closed down, leaving these tunnels full of water, and the water in the well at a level of the water in the dock. This gave a fixed and known quantity to be removed, and sufficiently large to afford a fair run of the pump. This was pumped out on two occasions, each of which gave a record beyond the requirements of the contract.

"The pump was charged with certainty and rapidity by means of the ejector at various levels of the water. This pump has been frequently used since its erection, and previous to the trial in removing the seepage water from the dock, and has always worked admirably."

The Board appointed for testing these pumps consisted of Captain F. V. McNair, U. S. N., Chief Engineer George F. Kutz, U. S. N., Civil Engineer C. C. Wolcott, U. S. N., who conclude their report as follows:

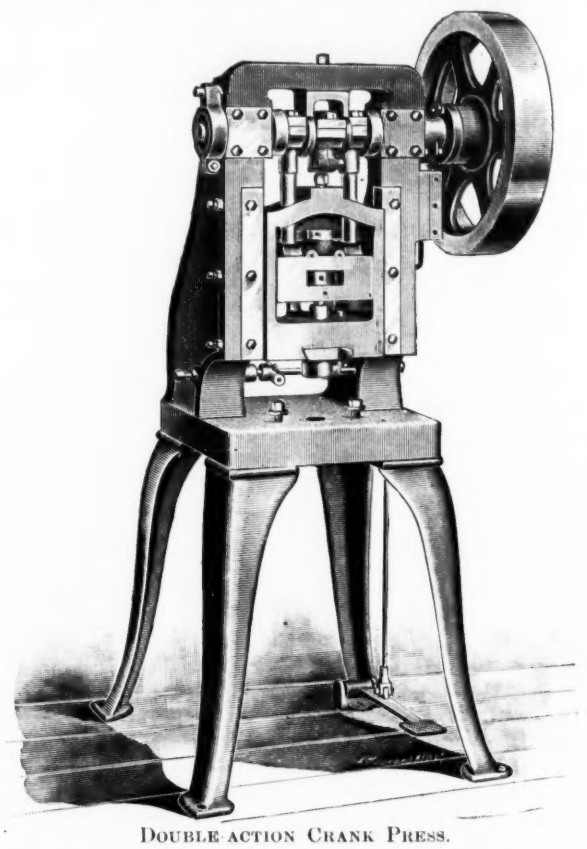
"In making these tests such conditions were imposed as would obtain in the usual operation of docking vessels, that is, the height of water in the dock was what it would contain were it occupied by an ordinary vessel, and with the state of the tide which would be chosen for beginning to discharge the water, giving a minimum of quantity to be removed. This, at the same time, gave a somewhat severer test in obtaining the requisite average of discharge, for with the water in the dock at higher levels, the quantity discharged in the first few minutes would be very large, bringing the average for the whole to a much higher figure.

"During the trial careful inspection of the machinery showed freedom from unusual vibration and smoothness in action, as the result of well-proportioned and well-balanced parts, and with uniform velocity in revolution indicated equal discharge from all the openings in the runner.

"Tests were also made with all the pumps as to the ability of their steam ejector to recharge them, and to continue pumping in case of stoppage or their losing the water at any point when the level of the water was below the center of the runner.

"The trial was had in the case of the main pump with the water in the suction tunnel on a level with the fifth altar of the dock; with the small drainage pump it was recharged when the water had entirely left the floor of the dock, and was not more than two feet above the floor of the well.

"Finally, the Board have to report that the obligation of the contract in the mean capacity of discharge per minute of each of the main pumps, and of the drainage pump, after a fair and thorough test, has been fulfilled, and that the general efficiency of each and all of these pumps is highly satisfactory."



DOUBLE-ACTION CRANK PRESS.

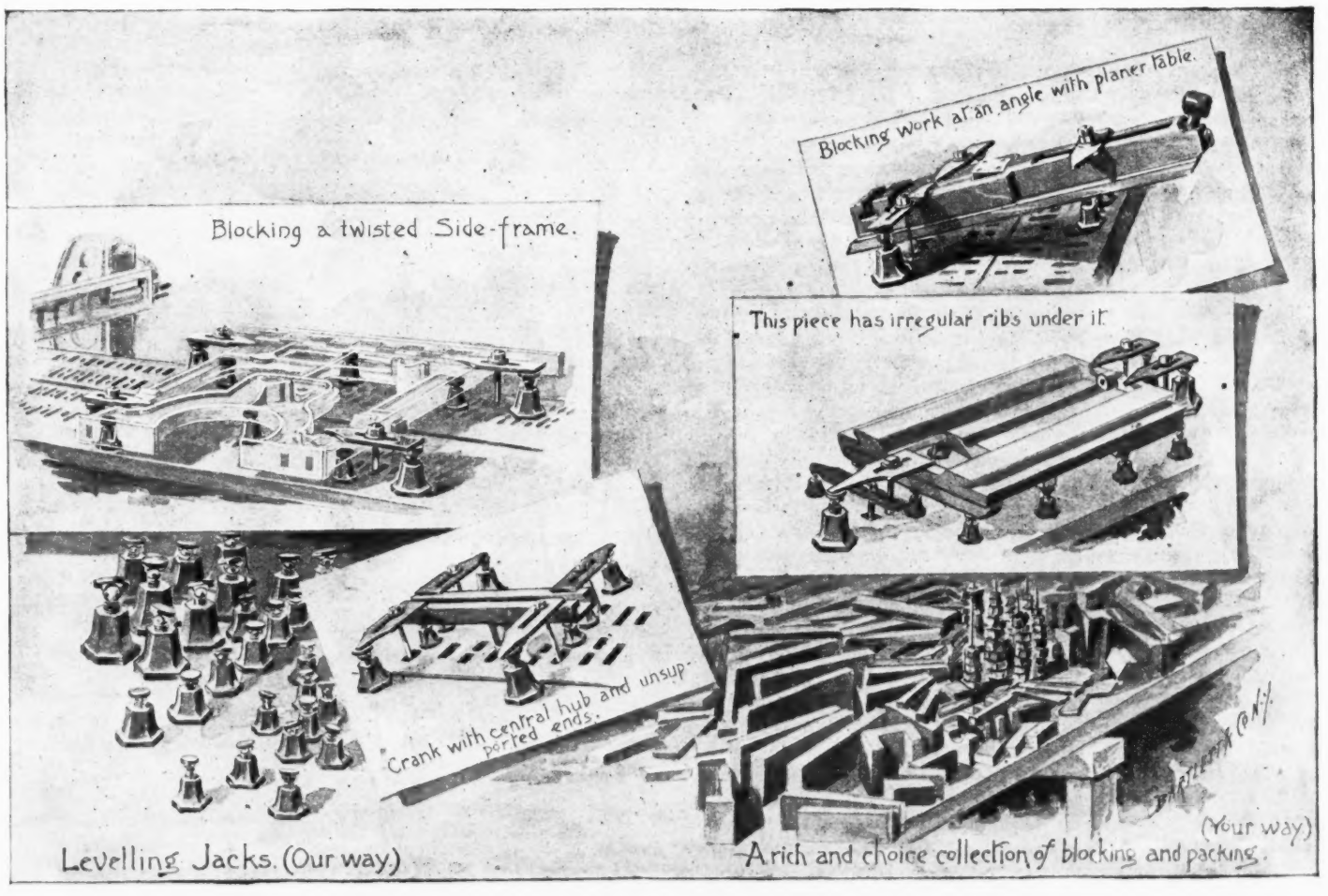
Double-action Crank Press.

We present with this a press recently brought out by Blake & Johnson, Waterbury, Conn., which possesses several new features believed to be important, amongst others such as permit of easy and accurate adjustment without danger of cramping the gate.

The two outer pitmans are solid, and do the drawing. They are connected with the sub-slide or gate (as shown in the engraving), which works inside the gate or slide that does the cutting. The sub-slide holds the drawing punch, the same as is used in the ordinary drawing press, and is adjusted in the sub-gate, up or down, as required, by means of nuts.

The cutting is done by the center crank of the shaft, and middle connection, which has a suitable adjustment for any work that comes within the range of the machine.

This press is provided with a finger motion and friction and safety clutch, the same as other presses made by this firm. A ratchet, friction or roll feed can be applied. Tools will be furnished, if ordered.


Blocking work at an angle with planer table.
Blocking a twisted Side-frame.
This piece has irregular ribs under it
Crank with central hub and unsupported ends.
Levelling Jacks. (Our way.)
A rich and choice collection of blocking and packing.
(Your way)

LEVELING JACKS.

Leveling Jacks.

The tendency to manufacture rather than make is very well illustrated in the cut which we present herewith. It is designed in part to show the leveling jacks—little jack-screws—made by the Newark Machine Tool Works, Newark, N. J., and in part to show the use of these screws in contrast with the heterogeneous pile of blocking and packing pieces which they take the place of. It is unnecessary to say anything to machinists about the convenience of these little jacks, as most of them have felt impelled at some time in their experience to make something that should serve, to some extent, their purpose, as for instance, a combination of a large nut, a set-screw and jam nut, etc. The construction of the jacks is so well represented as to leave nothing to say except in relation to the cap and top of the screw, which are of ball and socket form, so made that while the cap will adjust itself to an irregular or inclined surface, it will not fall off the screw.

LETTERS FROM PRACTICAL MEN.

Annealing and Hardening Steel.

Editor American Machinist:

From experience in quite a number of all around machine shops, I judge that the average process of annealing steel is very uncertain in its results. I have no doubt that a large number of those who read the AMERICAN MACHINIST every week have had experience similar to mine. How about that hard stock that gave you so much trouble in turning or drilling, and that you finally decided to have the blacksmith anneal? Did it prove to be softer after the annealing he gave it, or did it seem to be about the same, or harder?

Perhaps you have found that the blacksmith could "water anneal" stock so as to be softer than when he buried it in the ashes back of his fire, and then perhaps you have read in the AMERICAN MACHINIST that there is no such thing as "water annealing," and then you are obliged to think that somebody must be mistaken. I want to harmonize some of these matters that seem so contrary, or suggest a subject for experiment that will help others to understand the reasons for these contrary opinions.

It is well known to every steel worker that every grade of tool steel has its hardening heat, some higher than others, but whatever that heat may be, it is necessary to reach it before the work can be expected to harden. There seems to be quite a narrow line between a heat that will harden, and one that you can cool the piece as quickly as possible, and find it about as soft as before. This shows that the hardening heat made some change in the stock that a heat only a few degrees lower failed to do.

My experiments seemed to prove to me that this change brought about by a hardening heat is necessary in successful annealing; that one of the causes of failure is because the work is not heated to a hardening heat.

The golden opportunity to do annealing is by very slow cooling from the hardening heat down to a heat where it will not harden; below this point you may cool the work in water or in any other way, it will not make much difference for its power of hardening

is gone. The cause for unsuccessful annealing is because this golden opportunity is not made use of, either that the work has not been heated properly, or that it is not cooled slowly enough from its highest heat.

You bury the work in cold ashes, lime or powdered charcoal to make it cool slowly, instead of which it cools quickly until by its own heat it heats the surrounding ashes, in doing which, it is itself cooled below the hardening heat, then the harm is done, and it makes no difference if it does cool slowly after this.

This plan robs the steel of heat at a time when there is damage caused, and returns it at a time when it can do no possible good. Is there any wonder that the work comes out harder than before? You say, we do not bury the work in cold ashes but in hot ashes. How hot? Are they as hot as the hardening heat of the steel? Otherwise they will rob the work of heat at a time when it is most tender.

Now about that "water anneal." You hold the work in the air till it does not show red in a dark place, or will not burn a dry pine stick, then you cool it and find that it is pretty fair, not a good anneal, but softer than the piece you tried to anneal in the ashes, for the simple reason that you hardened that piece by contact with cold ashes when it was at a tender heat, but the piece that you "water annealed" you held in the air which did not convey its heat away so rapidly as the ashes did just at that critical time, but, of course, quicker afterward which did not count.

I do not give the water any credit.

You say that the water anneal makes steel softer than when it is allowed to cool off itself entirely in the air. This is because you do not let the work cool in air, but always look for a piece of cold iron or brick to lay it on, so that it will not burn anything.

To successfully anneal steel, heat it to its hardening heat, and do not let it come in contact with anything much cooler till it has got below its hardening heat, after which, the cooling may be more rapid.

A very successful way on a small scale, is to heat the work in a forge carefully, as carefully as you would to harden it, and to the same heat, then shut off the blast, and let it cool off with the fire. You can take it out as soon as the red has left it (I am not so sure but before will do as well), and cool it in water or in any other way, and if you find the result different from what I tell you, that is, good, let us know. Opinions are not of much value, but facts are hard to get over.

When it comes to annealing large quantities of steel of small sizes at one time, and doing it well at a small cost, I think that a close investigation of different ways that are used will show there is room for improvement.

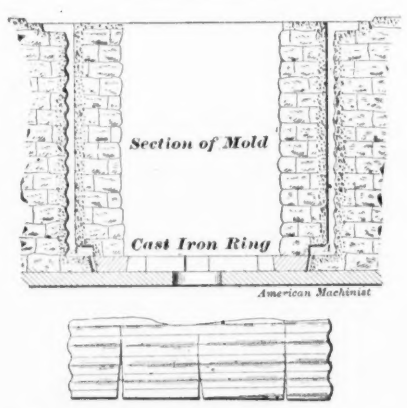
The difference between annealing and hardening is only the difference in time of cooling from a hardening heat. In hardening in oil, as oil will not convey heat from the steel as fast as water will, I should not expect work to come out as hard as in water, and experience has seemed to show that I got just what I expected, but I read about hardening in oil so hard that a good file will not cut the work, or in other words, as hard as a file. The file was hardened in water, and is supposed to be as hard as water will make it. Now, if we use some kind of a mixture that will make work as hard as water will, it shows that it must cool it as quickly, so why not use water?

I have supposed that the only virtue there was in oil for hardening was the fact that as it did not chill so quickly the stock had a chance to relieve itself of what might be dangerous strains, but at the expense of hardness. If anybody has a scheme for hardening in oil, so as to cool work slowly and bring it out hard as water will make it, it seems to me that it would pretty well break up the accepted theory of quick cooling as a means of hardening steel.

Oil is expensive and will not last long, as it gets cooked and its cooling power is damaged. It hardens a small piece about as hard as water will, and a large piece not at all, and intermediate sizes in some kind of a proportion that seems to me to be rather too uncertain for use. I knew a blacksmith who claimed to have made a great discovery in tempering edge tools, but whose scheme did not "pan out" very well, as I will try to tell you. He made a few axes to prove his new process (which shows that he was honest or he would have got it patented and sold the scheme before it bursted). The first one was excellent, the wood-chopper who bought it was in love with it. The second one was reported to be a good axe. The man who had the third one did not have anything to say, and the fourth one came back reported to be not good. After this the scheme did not work good at all. An investigation showed the cause. The mixture was simply soft soap. There was less than half a barrel of it, and it was found to be pretty well cooked, in fact, so well that its power of cooling was about as good as a loaf of gingerbread.

I knew another gentleman who hardened his work in water, after which he covered the surface with oil and drew the temper over a fire, and when I asked him how he knew when the temper was properly drawn (as he did not polish any part of it so that he could watch the color), he told me that he had got so used to it that he could tell by the smell. It seems that a change in the weather sufficient to give him a cold in the head would have a serious effect upon the temper of his work, so it seems to be a rather uncertain knack after all.

A MECHANIC.



Was the Fin that Broke the Drum the "Expected or Unexpected"?

Editor American Machinist:

Thinking the following incident that occurred recently, and which came under my notice, may be of some benefit to many of your readers, I thought it would not be out of place to record it in the AMERICAN MACHINIST.

Some 10-foot grooved winding drums were being made in a way similar to that shown in sketch—the middle or core was "bricked" and swept up on a heavy cast-iron ring, having four strong lugs cast on the inside for lifting the core on the core carriage. The outside was also "bricked" up in a pit lined with old boiler plates; the print part of the mold did not fit as closely as it should, owing to the outside part of the mold being swept too large to receive core ring, as seen at *A A*, so that when the drum was poured the iron ran down around the print, causing a heavy fin from $\frac{3}{8}''$ to $\frac{1}{2}''$ thick by about 3″ deep below the flange on the inside. This fin, of course, cooled quickly, and when the bottom of the drum began to shrink, this cold heavy fin was stronger than the hot sides of the casting, which caused three or four shrink cracks, as shown in sketch, varying from 6″ to 12″ up from the bottom of the drum. The cracks only ran a short distance toward the inside edge of the flange, but they seemed more inclined to run up the sides of the drum, opening most at the outer edge. The drum was ribbed on the inside, and the usual precaution taken by tearing down a few rows of bricks from the inside, to allow the drum to shrink and break in halves where the splitting plates were located.

Can the foregoing be properly called an accident or the "unexpected"? I think not. It was, no doubt, unexpected in one sense, but by the meaning that this word has been given in the AMERICAN MACHINIST, it seems to me that it would be more fitting to call it the "expected," for if a man neglects to attend to certain important details on a job, and it turns out defective, we say that "it was what might have been expected"; but on the other hand if, after every precaution has been taken, and through some unknown cause something happens, then I think we may fairly call it the "unexpected." P. S. DINGEY.

Chicago, Ill.

Horse-power of Gear Teeth.

Editor American Machinist:

I quite agree with "Bell Crank" in your issue of June 8th that "a simple rule for determining with considerable accuracy the horse-power of gear teeth is a desirable thing," and appreciating as I do his efforts in that direction, I regret to observe they have not been crowned with complete success; for, instead of one simple rule, good and true for all cases, he has felt obliged to offer two or three rules of indifferent pretensions to accuracy. His intentions were good and commendable, but it seemed, as he said, impossible to make one formula cover the ground with sufficient accuracy, and reflecting upon the peculiar relation which must exist between the strength and the number of teeth, I have been led to conclude that the difficulty encountered by "Bell Crank," in the form of his equations, was not insurmountable, and that a simple formula might be written to embody the number of teeth, and express very accurately the horse-power or working strength. In the general formula

$W = s\,p\,f\,y$ (1) given in my article of May 4th, where

W = working strength of tooth,
s = working stress of material per square inch,
p = pitch of teeth,
f = face of teeth,
y = factor for strength as there given in Table I,

we have for a cycloidal rack, $y = .124$, and for a 12-tooth pinion, $y = .067$, and, from an inspection of the table, it will be observed that the loss in strength from the rack to the pinion is inversely proportional to the number of teeth. A formula, therefore, that will properly express the value of y should be of the form

$$y = a - \frac{b}{n} \qquad (2)$$

in which a and b are constants to be determined, and n is the number of teeth.

In the case of a rack, $n = \infty$, $\frac{b}{n} = 0$, and $y = a = .124$.

Substituting the value of a thus determined, we have for a 12-tooth pinion, $y = .124 - \frac{b}{12} = .067$, from which $b = .684$.

The general formula for the working strength of interchangeable cycloidal teeth, therefore, becomes

$$W = s\,p\,f\left(.124 - \frac{.684}{n}\right). \qquad (3)$$

This formula agrees with Table I of my previous paper throughout, and I have no doubt it will be found that by changing the constants as required by the form of the teeth, the working strength of any system of interchangeable gearing may be properly formulated. For the system of cycloidal gearing, as described by "Bell Crank," it would probably be written

$$W = s\,p\,f\left(.124 - \frac{.888}{n}\right). \qquad (4)$$

The difference between equations (3) and (4) is due to the difference in the fillets used on pinions.

For the radial flank system,

$$W = s\,p\,f\left(.075 - \frac{.276}{n}\right), \qquad (5)$$

and for the involute 20° system,

$$W = s\,p\,f\left(.154 - \frac{.912}{n}\right). \qquad (6)$$

The size of fillets used on pinions of 20 teeth and under has a very marked effect upon their strength, and for external gearing there is no reason why these fillets should not be made as large as possible to clear an engaging rack. Certainly no tooth should have a fillet of less radius than the root clearance, and by careful construction I have found that pinions of 12 teeth may generally have two or three times that amount. For the common cycloidal system, having a root clearance of .05 p, it is quite safe to give the 12-tooth pinion a fillet of .15 p in radius, gradually reducing the size of the fillet as the number of teeth increases, until, for a 20-tooth pinion, the radius becomes .08 p. Everything above 20 teeth may then have the same radius of fillet. The fillets used by "Bell Crank" were very much smaller than they should be, and the differences in our results are thus easily explained. Where internal gearing is used, a slight reduction in these sizes may be necessary, but such gearing is now so infrequently required, that its consideration in an interchangeable system seems out of place. It is interesting to observe, however, that by giving n a negative value for internal gearing, equation (3) may still be used to find the working strength, and to a nice degree of accuracy.

Having found the working strength by equation (3), an expression for the horse-power is easily derived, and letting v = velocity at pitch line in feet per minute we have

$$\text{H. P.} = \frac{W\,v}{33{,}000} = \frac{v\,s\,p\,f\left(.124 - \frac{.684}{n}\right)}{33{,}000}, \qquad (7)$$

but, in general, the important thing to know in machine design is the working strength of gearing or belting rather than the horse-power, which in many cases bears no direct relation to it, as in punching and shearing machines, which consume power intermittently. Equation (3) is, therefore, the key to the whole question, and the following example will serve to illustrate its application and scope:

Let $p = 1$, $f = 2.5$, $s = 8{,}000$, and $n = \pm 30$, then

$$W = 8{,}000 \times 1 \times 2.5\left(.124 \pm \frac{.684}{30}\right) =$$

2,020, for the external wheel of 30 teeth, and 2,940 for the internal wheel of the same number of teeth.

The above formulas can, of course, be written with reference to any given material for the introduction of safety factors, instead of the working strength, but such a change would simply make them less applicable to all materials, and detract from their clearness and usefulness. A factor of safety has a definite meaning only when the ultimate strength is kept in view, an obvious fact which is constantly overlooked, and in the formulas proposed by "Bell Crank," the ultimate strength fails to proclaim itself. The working stress, however, when substituted in a formula prepared to receive it, is in itself a definite statement of what the material under consideration is allowed to carry, and in modern engineering practice it cannot be denied that the working stress is based more directly on the elastic limit of the material than upon its ultimate strength. Experimental research is demonstrating the absurdity of the old-fashioned factors of safety, and, although they are still employed to indicate a supposed margin of reserve strength, they must be characterized as clumsy and misleading devices, which cannot be relegated too soon to the follies of the past.

WILFRED LEWIS.

Double and Single Cutters for Gearing.

Editor American Machinist:

In your issue of June, Mr. Grant states that there is no economy in the use of the duplex cutter. He is mistaken. To begin with, to use week in and week out on one job, a pair of duplex cutters are worth as much as two single cutters would be; the economy in time spent shifting and setting cutters would amount to more then generally supposed in favor of a duplex cutter. This item alone would make the cutter cheap at twice its cost. The duplex cutter

also has a wide range of use. It not only cuts all gears of same pitch, but will cut both diametral and circular pitches once going over; also, will cut both pattern gears and standard once going over. The idea is that there is an adjustment between the cutters; they can be used singly for cutting bevel gears and odd pitches. Now as to the shape of teeth, I will admit that the involute is in general use, and probably answers for common and most of gearing very well, as a slight variation in cutting or sizing makes apparently no difference; but it is no better, nor as good a shape for common gearing as a more uniform tooth on all sizes of wheels. The epicycloidal, of course, is a better shape if the proper care and pains are taken to produce it and keep in place, but the double curve gearing should never be used only in the very best and most particular places. The relation of the pitch line on one wheel to the pitch line to its mate is very essential; not so with the single curve gear.

A word in regard to interchangeable gearing: If Mr. Grant furnishes his trade with this sort, 12 teeth to a rack, using 8 single cutters, he cannot produce the very best; the best can be made only with special cutters of whatever style may be used; the interchangeable system is fit only for common ordinary work. R. M. CLOUGH.

Vise Shields.

Editor American Machinist:

I see by your issue of May 25th that the Newark Machine Tool Works have patented a paper shield for vise jaws. I send you a pair of rawhide shields with tin inside to protect them from the vise jaws. Those I send have been in use for four years. The way I make them is to first form the tin to the vise jaws, then get a piece of rawhide, wet it, and sew it over the tin on the vise jaws, and leave till dry. I think this makes a very convenient vise jaw, and it is not patented. J. A. O'DONNELL.

Fresnill, Mex.

[The tin inside, of which our correspondent writes, is made as one would make a copper shield, the rawhide being molded around it when wet, with no seams in it; the rawhide covers the whole of the outside of the tin, and when dry retains its shape. It makes a very good shield.—ED.]

Wants Information.

Editor American Machinist:

I should be glad if any of your readers with special experience in this line would be kind enough to give me some information relative to the best way of boring holes for main bearings in milling machines and lathe heads when these holes are required to be taper. Doubtless the information will be interesting to quite a number of your other readers. ANGLO-AMERICAN.

Patterns for Sprocket Wheels.

Editor American Machinist:

Some time ago one of your subscribers made inquiry about making a pattern for sprocket wheel for link belt. I have figured about all the kinds of pitches in existence, and can handle tooth gearing, but must admit I have been unable to work to my figures and make a satisfactory wheel every time. I visited the works where the chain was made a number of years ago, and I observed closely how they tested the chain, and it set me to thinking. The chain is put together in lengths of 10 feet. It is then tested by gauge by stretching to the limit, or above working strain, and any weak links that break are replaced and tried again. Any one having much experience with working malleable iron knows there is no metal so deceiving as to annealing as malleable.

When this chain is being tested or stretched, some links lengthen more than others, and this partly is the cause of trouble in making sprocket wheel patterns. I have not had any trouble since I adopted the following plan. It is a little trouble, but pays big in the end. Say I want to make a wheel with 20 teeth. I take 20 links and fasten them all together, making a circle of them. I turn up a piece of stuff in the lathe to just fit snug inside of this ring. From this diameter I make my pattern, allowing for shrinking, etc. By this means we get the aggregate diameter and safe working one.

A good test is for one to try and figure the diameter needed, or get some expert, and you will soon find out like I did my figures would lie on sprocket making. By this means we get an exceptionally good working wheel. W. H. DAVIS.

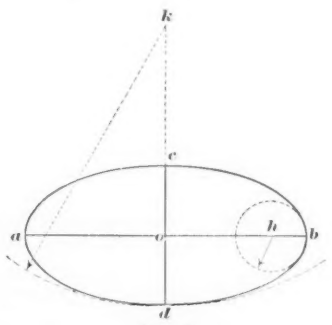


Fig. 5

The Ellipse.

Editor American Machinist:

In my desire not to make my previous communication on the ellipse too lengthy I omitted the analysis of the construction of Figs. 1 and 2, which may be of interest to some of your readers.

The question may very properly be asked, *What is the principle of this construction?*

We learn from the calculus that the radius of curvature at the vertex of an axis of an ellipse is a third proportional to the semi-axes.

Let *a d b c*, Fig. 5, be an ellipse. A third proportional to the semi-axes is easily found as follows: Draw any angle *a' o g*, Fig. 6. From *o* as a center with radii equal to the semi axes draw the arcs *a a'* and *c c'*.

Join *a c'* and draw *c f* and *a' g* parallel to *a c'*; *o f* is a third proportional to *o a* and *o c*; and *o g* is a third proportional to *o c* and *o a*.

Lay off *b h*, Fig. 5, equal to *o f*, and from *h* as a center draw the circle through *b* which represents the curvature at the extremity of the major axis. This circle while coinciding with the curve at a single point *b*, falls wholly within the ellipse.

Lay off *d k*, Fig. 5, equal to *o g*, Fig. 6, and from *k* as a center draw the arc through *d* which represents the curvature at the extremity of the minor axis. This arc, while coinciding with the curve at a point *d*, falls wholly without the ellipse.

It will be seen then that in order to draw arcs which will apparently coincide with the ellipse, a radius greater than *h b* and one less than *k d* must be employed.

The lengths of these radii are determined by the construction of Fig. 2, and if the question is asked why *a e—one-eighth* of *a c*—is laid off, the reply is that on testing the construction with ellipses of various proportions, *one eighth* yields a better result than one-seventh or one-ninth. It is possible that a fraction, having some other figure but unity for its numerator, might be determined which would give a result a little more accurate; but the draftsman who tests the fraction *one eighth* will be convinced that any further refinement is unnecessary and inconvenient. F. R. HONEY.

Device for Testing the Soundness of Locomotive Axles.

Editor American Machinist:

In view of the fact that main driving axles of locomotives break directly on the inner side of hub, and further, before severance is complete, the crack or break has passed the center of the axle, I would suggest the use of the following device and its attachment for discovering whether such break or crack has advanced to this point, and the necessity of withdrawing the axle from service First drill a ⅝-inch hole more or less in the center of the axle in the direction of its length to within an inch of the inside of the hub. Then use a smaller drill until you have exceeded the distance through the hub by an inch or less. This can be done with care not destroying the center. If the countersink in center is too small it should be enlarged before drilling. Then attach a 15 or 20-ton hydraulic jack to the axle by means of clamps and pipe as shown in the sketch. A hole can be drilled in the jack for the attachment of the pipe. It might be well to drill this hole as near the bottom of the barrel as possible; it should be tapped (fine thread) so that it can be plugged when the jack is not used for this purpose. With a 15-ton hydraulic jack in good working order with a 3 inch ram, it should be possible to get a pressure of 4,000 pounds to the square inch, which pressure, I think, would find its way through any crack or break in the axle.

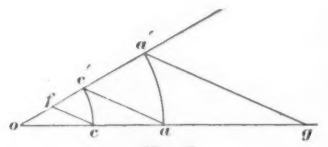
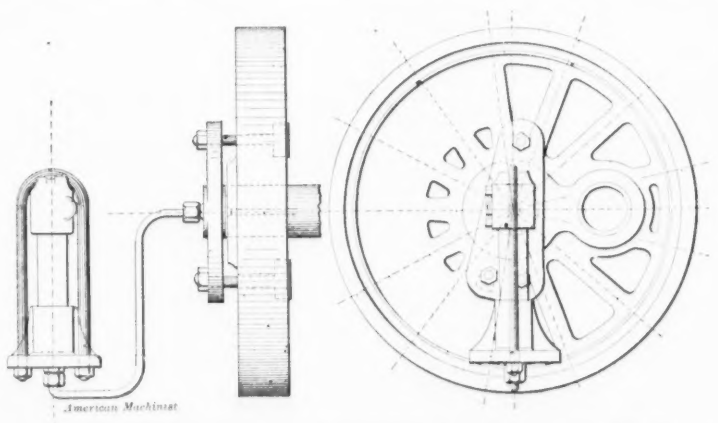


Fig. 6

This device can be attached to a locomotive driving wheel without the removal of the rods. MACHINIST.



DEVICE FOR TESTING THE SOUNDNESS OF LOCOMOTIVE AXLES.

Gas Pipe Threads and Taps.

Editor American Machinist:

Lately the foreman of the machine shop gave me a blue-print containing a list of standard sizes of "pipe taps," "tap drills," "number of threads to the inch," etc., saying it would be handy in the tool room, and thinking myself that it was a good thing, I tacked it in a convenient place. Now I have cut a large number of 1¼" and 1½" pipe nipples in my time, and have always cut 11½ threads to the inch; and as I was making a 1¼" pipe tap lately, I was about to gear my lathe to cut 11½ threads, when I thought I would see if I agreed with the blue print (which was copied from Haswell,) and there I found 11 threads to the inch was the standard, but thinking the draftsman had made a mistake, I called his attention to it, and on his comparing it with the book found it correct. Now I don't say Haswell is wrong, but I could not make myself believe I had been cutting the wrong thread for the last ten years, so I thought I would look the matter up, and on referring to other authors I find some say 11 threads and others $11\frac{89}{100}$ threads was the standard, so by this time I was pretty well mixed up, and did not know what pitch to give the tap, but I concluded to risk 11 to the inch. Now lately one of the men called for a 1¼" pipe tap and I gave him the new one thinking it would be a good time to try it, but he on comparing it with a common 1¼" plug (which he was going to use in the hole) found they did not have the same pitch, as the plug was 11½ to the inch. Now what I would like to know is, if 11 to the inch is the standard for 1¼" pipe, why do the manufacturers of taps and pipe fittings cut 11½ pitch; and again, in cutting a thread on a tapered piece, should the thread tool be set square with the taper or the shank of a tap? I have seen them cut both ways, but cannot find out which is right. Joshua Rose says in cutting a tapered thread as on a pipe tap, the tail-stock of a *lathe* should be set over, for if the taper attachment is used it alters the pitch. Now I would like to know if it makes any *practical* difference, and if so, how much?

I hope to hear from some of my brother machinists on these few points. P. H. C.

[The standard pitch of gas pipe threads for the sizes named is 11½. We believe the tool should be set square with the center line of the tap.—ED.]

Theory of Injectors.

Editor American Machinist:

I note in your issue of June 8th, 1893, Mr. Booth's reply to my criticisms of his theory of injectors.

Mr. Booth has failed to read my criticisms carefully, or he would not make such wild statements as to what I said or meant.

In his reply to me, Mr. Booth says,

"*I never pretended to give correct equations.*"

If he had put that in his original paper, I would never have criticised it.

I still maintain that any writer who attempts to explain the *theory* of any machine, and then gives *theoretical equations* that are not correct, does wrong, and the results obtained by the use of those incorrect equations are wrong and misleading.

The men who read the AMERICAN MACHINIST are, I think, competent to understand correct equations, and it is a piece of presumption for any writer to assume otherwise, and, therefore, to give incorrect equations in order that he may reach what he considers is their low grade of education and ability. Even the man who is not a college graduate, or who is not familiar with algebra, prefers to have correct equations rather than those that are not correct. It is better for a writer when discussing a theory to omit all equations rather than to *intentionally* give those that he knows are not correct. J. H. KINEALY.

An Error in Speed Variation.

Editor American Machinist:

"Errors in Indicator Reducing Gear," by M. E., was very interesting to me. Doubly so when I notice the author correcting a mistake of principle, while he falls into equally as bad an error in the previous issue of the AMERICAN MACHINIST. I refer to a statement in the first column of page 4 of the issue of June 1. "The variation in speed is double, if both pulleys are variable," is the substance of the statement. If the variation for one pulley is 38.22 per cent. the per cent. variation for two pulleys is $(138.22)^2 - 1$. To illustrate, let us take an exaggerated case (as M. E. does in the indicator gear). Suppose it possible to vary each pulley by 200 per cent., and take the pulleys (for simplicity) of the same size. In the first case (minimum ratio) the velocity of follower to driver is ⅓. In the second case (maximum ratio) the velocity of follower to driver is $\frac{3}{1}$. That is, the ratio of maximum velocity to minimum velocity of the follower is 3^2 or 9. The increase in velocity is $9 - 1 = 8$.

E. J. F.

Not long ago some Western train robbers stopped a railroad train and run the baggage car a mile or two away, when they found out that they had stopped a way train instead of an express train. It was a case of mistaken identity.

It makes it bad for army officers, the decision that they must board themselves at Chicago while on detail duty there. Ordinary mortals who have to do this will sympathize with them.

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☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

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NEW YORK, JUNE 22, 1893.

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Headquarters at the Fair.

During the continuance of the Chicago Exposition the AMERICAN MACHINIST will have its headquarters in the space allotted to the Mechanical Press in Machinery Hall. The exact location is Section No. 27, Column K 37. Word can be left with the attendant there by any one who is desirous of meeting a representative of this paper, who may at the time be engaged elsewhere on the grounds.

What is a Corliss Engine?

One not versed in matters pertaining to the steam engine, and ignorant of just what constitutes a Corliss engine, might have considerable difficulty in these days to determine just what a Corliss engine is or was. The distinctive features of this engine, as built by its originator, were in the form of bed; in having two steam valves at either end of the cylinder on top, and two exhaust valves at either end below; in its round or cylindrical valves, with their oscillating motion; in its wrist-plate motion for actuating these valves; and finally in the detaching device for enabling the governor to control the point of cut-off. Our ignorant visitor to the Exhibition at Chicago who should go about the power plant there might conclude, not only that any one of these features might be dispensed with, and the engine still be a Corliss; but that nearly all of them could be discarded, and still the name would apply. There are Corliss engines there that have not the Corliss form of bed-plate; others that have no oscillating valves; others that have no detaching device; and still others that have no wrist-plate motion. Usage seems almost to have justified the application of the name Corliss to any engine which has four valves and an automatic variable cut-off.

The circumstance is certainly a great tribute to the genius of George H. Corliss—a tribute which no one interested in him or his fame can in the least object to; but it is questionable if there is the commercial advantage in it for some of those who pay the tribute that they think there is. Chas. H. Brown's engine is certainly as much a Corliss as some of those "hyphenated Corliss" engines, which, however excellent they may be as engines, resemble the Corliss scarcely at all. It is extremely doubtful if he would have sold more engines if he had called his engine the Brown Corliss.

Where an engine has some of the features now considered essential to good practice, and is large enough to make the contract for building it amount to something, its selection depends usually upon the judgment of a man who knows what there is about it that is the invention of Corliss, and what is not. And he also knows what features are superior or inferior to the Corliss, and his choice will not be much, if any, affected by the name which the machine may bear.

This is not offered as a criticism of those who choose to apply the name Corliss to their engines, for we believe it is perfectly right for them to use the name if they think the engine embodies Corliss features, and should properly be classed as Corliss. We are only calling attention to what is growing to be a somewhat curious feature of the engine business.

Ethically it is certainly much superior to the course of those who, adopting the features originated by others, carefully avoid giving any credit for them whatever, either in the naming of the machine, or in any other way.

Progress and the Mechanic Arts.

The part that the mechanician plays in the world's progress is well exemplified in the instance of the modern transatlantic steamship. And the fact that each succeeding effort represents an advance over preceding efforts, shows that the end is not yet. When the "Paris" and "New York" made their appearance it looked as if little more could be hoped for, but very soon comes the "Campania" eclipsing everything that had gone before, but no doubt soon destined to be left in the rear through the increasing sum of mechanical and engineering skill. Thirteen or fourteen knots per hour was, not so very long ago, thought to be the limit of steamship speed. Now, no one is rash enough to fix a limit; and comfort and elegance of the appointments have kept pace with speed.

In considering such a work as the "Campania," we are apt to associate everything with the name of the designer, as if to him belonged all the credit, just as we give the general in full command all the credit for battles won. Nothing could be farther from the truth. The "Campania" is perhaps the best example—certainly one of the best examples—in existence of mechanical and engineering skill and progress. It represents not the work of one or a dozen men, but the skill and inventive genius of thousands, which has made possible such a result. Great credit is due those who were able enough to collate, so to speak, the knowledge of the many, and to put it to harmonious use, but the knowledge and the skill in such matters, contributed by the many who have perfected themselves in the details that have been aggregated in the "Campania," making of her such a remarkable example of human skill, is at the bottom of the success attained

The original engineer, we must assume, took the materials furnished by nature and bent them to his use, according to his needs and ability. The modern engineer takes, largely, the products of others—the crystallized thoughts of generations—and adapts them to the purposes in view. Nothing but praise should be accorded the skill and knowledge that can accomplish this; it is knowledge and skill of a high order in many instances, but it does not alter the fact that the possibility of such a vessel as the "Campania" is due to the working of many minds; is an embodiment of the knowledge of the many. This most remarkable of modern steamships is not the work of the architect, the engineer and the mechanic—it is the work of architects, engineers and mechanics.

Comparing the "Great Eastern" with the "Campania" gives a very fair idea of the advances that have been made in the mechanic arts within a few years. The former was a great failure, not because of lack of ability of her designer, but because there was not enough collateral skill and knowledge from which he could draw. The latter is a correspondingly great success, because that collateral skill and knowledge is now at hand. And the "Campania" will be eclipsed because the sum total of knowledge of the mechanic arts is being rapidly added to rather than because some abnormally smart designer of steamships will arise. It is a question of universal knowledge, diversified as it is sure to be, that brings about great progress. Such progress is one of the best of arguments in favor of the higher education of the masses.

Every few days some friend of the AMERICAN MACHINIST writes us expressing his regard for the paper, and asking us, as a favor, to send a specimen copy to the address of some friend of his, who, as he thinks, would be likely to appreciate such a paper, and to become a regular reader of it. A case in point at the present moment is an English subscriber's request that we send a specimen copy to a firm of engineers, friends of his in South Africa. Now we would like to say that in such cases the favor is a mutual one, and that any reader who desires to extend the influence of the AMERICAN MACHINIST has only to give us the address of any friend, in any part of the world, in whose hands he would like a specimen copy placed, to have his wish gladly complied with.

The day of wooden shops and factories is fast departing, iron largely taking the place of wood. The building of iron shops has been brought so near to a science that a man can, as Chordal would say, be measured for a shop very much as he would be measured for a suit of clothes, and with just about the same consideration for his pocket-book. And he can come mighty near getting it "Saturday night" at that. It is a comfortable way of getting the shop, and makes a good business for the manufacturer. It is one item in the general line of a division of labor that prevails so extensively at of present time.

The wisdom of the policy of the government in offering a bonus for speed of cruisers and warships in excess of that called for in the contract is made apparent in very nearly every trial trip of a government vessel. As a matter of course, the builders are desirous of getting as large a sum as possible, and to that end may be depended upon to spare no pains. They quite generally make a very nice sum indeed, which is good for them, and they secure to the government a better class of vessels than would otherwise be the case, which is a still better thing for the government.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(303) H. H., New York, writes: Please inform me how I can mark my hardened square and other tools. What kind of acids are used? *A.*—Use pyroligneous acid, 4 parts; alcohol, 1 part by measure. Mix and add 1 part double aquafortis.

(304) N. W. M., Philadelphia, Pa., writes: Kindly inform me what books treating on steam and the steam engine are suitable for a person who knows nothing about them. *A.*—"Elementary Manual on Steam and Steam Engine," by Professor A. Jamieson, we believe will suit your purpose.

(305) G. T. H., New York, writes: Please give a receipt for a lacquer to be used on brass castings after they have been finished. *A.*—A lacquer for dipped work may be made thus: Alcohol, 12 gallons; seed lac, 9 pounds; turmeric, 1 pound to the gallon; Spanish saffron, 4 ounces; the latter may be omitted if the lacquer is to be very light.

(306) J. A. M., Chicago, Ill., writes: Kindly inform me how to lay out the teeth of gears especially in regard to obtaining the radii for the curves of the profile. I saw it used but forgot that part. *A.*—See page 6 in our issue of April 27, current volume. For accurate work we should advise you to study the articles on Odontics, by G. B. Grant, commenced in our issue of April 17, 1890.

(307) H. S. R., Newark, N. J., writes: I wish to build a cannon of gun metal, 1-inch bore; it will not be a breech loader. Kindly give me information as to its proportions, as I wish it to be perfectly safe, and also of a good appearance. *A.*—Cannons are dangerous things to fool with, and we would therefore advise you not to attempt to build one, but to buy one of a manufacturer who can give a guarantee of its safety.

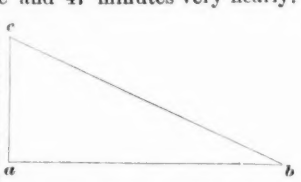
(308) G. E. B., Lynn, Mass., asks: What is the difference between a segment and a sector? I have had an argument and am anxious to know the definitions of each word. *A.*—This is another case in which time is wasted in argument, as any difference of opinion on subjects of this kind could be settled in less than two minutes by referring to a dictionary, or to an elementary geometry. A segment is a part of a circle included between an arc and its chord. A sector is a part of a circle included by an arc and the two radii drawn to its extremities.

(309) B. F., Detroit, Mich., writes: Please inform me how to prevent grain marks from showing in cast iron crank-shafts after they have been finished in the lathe. The shafts are from 2 to 4 inches in diameter. *A.*—These could be prevented from showing by slightly hammering the surface before the final finishing cut is taken, but we should not advise you to do so on crank-shafts. The best way is to have the shafts cast of suitable iron, and the marks which may show after finishing will do no harm. 2. Please give me some advice in regard to crank-pins; they are far from round when finished. *A.*—We suppose you refer to

pins cast to the cranks; the only advice we can give is to balance the cranks and shaft thoroughly in the lathe, then with proper care in turning the pin you should obtain satisfactory results.

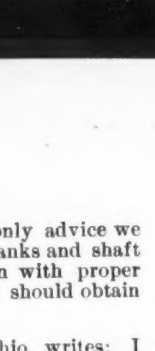
(310) G. P. G., Findlay, Ohio, writes: I have a boat 22 feet long, 4½ feet wide and 2 feet deep, of good model. Kindly inform me what size of engine will be required to run it. Steam pressure 100 pounds. *A.*—Diameter of cylinder, 2¼ inches; stroke, 3 inches. 2. Please give size of ports, diameter of piston rod, diameter of shaft, length and diameter of connecting rod, diameter and pitch of propeller. *A.*—Size of steam ports, 1x$\frac{5}{16}$ inch; exhaust port, 1x$\frac{5}{8}$ inch; diameter of piston rod, ⅝ inch; diameter of shaft, one inch; length of connecting rod, 7½ inches; diameter at neck, ⅝ inch; diameter of propeller, 14 inches; pitch, 24 inches.

(311) J. B. L., Charleston, S. C., asks: How can I find the angle in degrees of different tapers? For example, how many degrees are there in the angle formed by the two lines *a b* and *b c*, the line *a b* being 12 inches long, and the line *a c* perpendicular to *a b* is ⅜ inch long? *A.*—Divide the length of *a c* by the length of *a b*, the quotient will be the tangent of the angle. Thus, remembering ⅜ = .375, we have $\frac{.375}{12}$ = .03125 for the tangent. Look for this in a table of natural tangents, sines, etc., given in any good engineers' pocket-book, and opposite to this number you will find the number of degrees in the angle; in this case, 1 degree and 47 minutes very nearly. 2. How can I find the number of cubic inches in a piece of round iron 1 inch diameter and 10 inches long?



A.—Multiply the area of the circle 1 inch in diameter in square inches by the length of the bar in inches, the product will be the number of cubic inches; in this case we have .7854 × 10 = 7.854 cubic inches.

(312) C. M., Cincinnati, Ohio, writes: The accompanying sketch shows a train of gearing driven by a pulley. Will the speed of the gear with 22 teeth, relatively to that of the gear with 88 teeth, be increased by putting the 24 toothed wheel in place of 26 toothed wheel and the latter in place of the former? *A.*—No, the speed of 22 toothed gear will be decreased. With the gears as shown in the sketch the 88 toothed gear will make $\frac{26 \times 24}{86 \times 88}$ = .0824 of a revolution duringthe time the pulley makes one revolution and the 22 toothed gear will make $\frac{26}{22}$ = 1.18 revolutions in the same time. With the change as you propose the relative speed of 88 toothed gear will not be changed, but the speed of the 22 toothed gear will then be $\frac{24}{22}$ = 1.09 revolutions.



(313) J. R. R., Troy, N. Y., writes: Please answer the following: What weight of steam will one pound of water make? *A.*—One pound of water will give one pound of steam. 2. How much water will it take to condense it? *A.*—That depends on the temperature of the steam, of the cooling water, and of the hot-well, or receptacle into which the air pump delivers the products of the condenser. Let T_1 be the temperature of the steam; T_0 the temperature of the cooling water, whose quantity in pounds is Q; T_2 the temperature after condensation or that of the hot-well. We then have,

$$Q = \frac{1{,}114^\circ + (0.3 \times T_1) - T_2}{T_2 - T_0}.$$

To show the application of this formula, we will take the following example: Find the amount of injection water required for an engine exhausting the steam at a temperature of 193°, the temperature of the injection water is 60°, and the temperature of the hot-well is to be 120°.

$$Q = \frac{1{,}114^\circ + (0.3 \times 193^\circ) - 120^\circ}{120^\circ - 60^\circ} =$$

17.53 pounds. That is, the amount of injection water is 17.53 times the weight of the steam for this particular case. For further information on this subject see "Manual of Marine Engineering," by A. E. Seaton, from which the above has been taken.

(314) E. P., ——, asks: Will a 12x20 engine cutting off at ¾ stroke run a barge 100 feet long, 40 feet beam, and drawing 8 inches of water, up the Mississippi River at the rate of 5 miles per hour? If so, at what speed should the engine be run? *A.*—Your question is a very indefinite one; you have not given the boiler pressure, velocity of current, nor the form of the hull; but on general principles we should say that the engine is large enough for the purpose. We should run the engine at a rate of 150 revolutions per minute. 2. I intend to use a paddle wheel at the stern. What should be its diameter, and at what speed should it be run? *A.*—We should make the mean diameter of the wheel, that is, from center to center of floats, 8 feet; for a current of 5 miles per hour, it will have to run at the rate of about 44 revolutions per minute. 3. I intend to drive the wheel by means of a chain running over sprocket wheels. What should be the size of the chain? *A.*—That depends on the diameter of the sprocket wheels; if the chain is to run at a speed of 440 feet per minute, the aggregate area of the cross section of the chain or chains should be about 1¼ square inch. Of course, the foregoing items are, for the want of sufficient data to base the calculations on, approximations only, but will serve as a guide in designing the machinery.

(315) F. C., Montreal, Canada, writes: I intend to take up mechanical drawing as a profession, but I do not know how to proceed, as I cannot go through a college course on account of the lack of means. Consequently I concluded to get your advice as to what course I should pursue. Could I learn it out of books? If so, which books would you recommend? *A.*—You can learn this from the instructions given in the papers treating on practical drawing which were published in the AMERICAN MACHINIST a few years ago. We can furnish all these numbers. A draftsman requires to know more than simply making a drawing, hence we should advise you to follow the course given in our issue of February 19, 1891. 2. Could I get a position as tracer in the United States, and learn it in that way? *A.*—You may obtain such a position, but that depends more upon good luck than anything else, as these positions are generally sought and taken when a vacancy occurs. We should advise you to stay where you are, and start as an apprentice in a machine shop, so as to get practical experience, as all good draftsmen should have, and devote your leisure hours to study. When you have progressed so as to have sufficient confidence in your own ability to make ordinary or simple designs and drawings, you will undoubtedly meet with opportunities to enter the drawing room.

(316) E. M. G., Montpelier, Vt., writes: We are designing a traveling crane which is to lift 35 tons; its type is shown in Fig. 1. We cannot find a rule or formula by which we can calculate the strain on the truss rods, of which there are four. The main timber is 12 inches deep and 14 inches wide, hard pine, and the end fastenings and posts are very heavy. Please give a rule by which the size of the truss rods can be computed, also the distances L, x, y, and d. *A.*—The distance L depends entirely on the space which the crane has to span. In what follows we shall assume it to be 42 feet. The distance y, that is, the length of the struts, is to some extent arbitrary.—we should make it ⅓ of the span; hence for the length of struts we have $\frac{42}{8}$ = 5.25 feet. The distance x should be ⅓ of L, $\frac{42}{3}$ = 14 feet, leaving 14 feet from the center of each strut to the end of span. To find the stress in the truss rod t, we proceed as follows: Assume that the weight to be lifted (35 tons) is concentrated on a single point a directly over the center of the left hand strut, the first step will be to find the reaction at c. To do so, multiply the distance from a to b by the weight to be lifted, and divide the product by the length of span L; thus $\frac{28 \times 35}{42}$ = 23.33 tons, which is the reaction at c. Now lay off a vertical line, as shown in Fig. 2, and make its length C equal to the length of the strut, 5.25 feet. Any scale may be used for this purpose. Through the upper end of the vertical C draw a horizontal line, and through the lower end of the vertical draw a line parallel to the end t of the truss rod, intersecting B and thereby completing the triangle, as shown in Fig. 2. Let us assume that we find, by measurement, the side B to be 14 feet long, and the side T 14.95 feet long. The length of T will now represent the tension in the truss rod; the length of B, the compression in the wooden beams, and C a compression equal in amount to the reaction at c (23.33 tons). The stress in the rod T will be just as much greater than that represented by C as T is longer than C; hence the stress in the truss rods T will be $\frac{T}{C} \times 23.33 = 66.25$ tons. There are 4 truss rods, hence the stress in each will be $\frac{66.25}{4}$ = 16.56 tons, or 33,120 pounds. The tensile stress in these rods should not exceed 10,000 pounds per square inch, hence the cross-sectional area of each rod should be $\frac{33{,}120}{10{,}000}$ = 3.31 square inches; the corresponding diameter is nearly 2¼ inches. For a moving load, such as we have in this case, two diagonal braces e and f, as indicated by the dotted lines which we have added in the sketch, will be required. Now let us examine the strength of the wooden beams; we assume that there are two of them. Since the span is divided into three equal parts, we need to take into consideration one section only, that is, we assume that we have to deal with a beam 14 feet long supported at the ends and loaded in the middle with $\frac{35}{2}$ = 17.5 tons. Under these conditions, the upper side of the beam will be compressed, and the total amount of compression will be that due to the load, and that due to the truss rods. The total amount of compression in a wooden beam on its upper fibers should not exceed 1,100 pounds per square inch. The compression due to the load is found by the following formula:

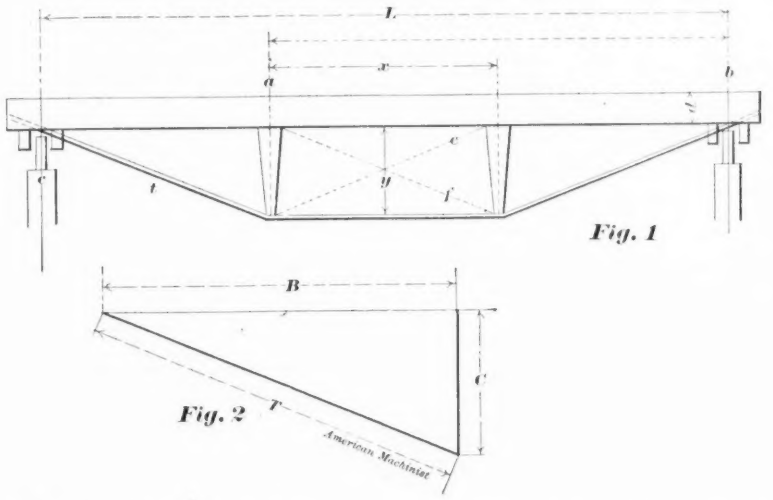


Fig. 1

Fig. 2

$$S = \frac{1.5 \times W \times l}{b \times d^2};$$

in which S is the compression on the upper or outer fibers, W the load in pounds, l the length of the beam in inches (168 inches in this case,) b its breadth in inches and d its depth in inches. The breadth and depth as given are 14 and 12 inches respectively. Substituting for the symbols in the formula their values, we have:

$$S = \frac{1.5 \times 17\,5 \times 168}{14 \times 12^2} = 2.18 \text{ tons},$$

or 4,360 pounds per square inch. This shows that, even without taking into account the compression due to the truss rod, that the compression is four times greater than it should be, and consequently the beam is not large enough. Now let us consider the strength of a beam 19 inches wide and 28 inches deep. Applying the last formula, we have:

$$S = \frac{1.5 \times 17.5 \times 168}{19 \times 28^2} = .296 \text{ ton},$$

or 592 pounds per square inch. The compression due to the truss rod is represented by the line B in Fig. 2, and the amount of this compression is as much greater than the reaction at c, and represented by the side C of the triangle in Fig. 2, as B is longer than C. Now B is 14 feet long, and C is 5 25 feet long, and the latter represents, as we have seen before, 23.33 tons, hence the compression due to one truss rod is $\frac{14}{5.25} \times 23.33 = 62$ tons, or 124,000 pounds. But there are two truss rods to each beam, hence the total compression in each beam due to the truss rods is 248,000 pounds. This is distributed over the cross-sectional area of the beam, which is 19 × 28 = 532 square inches, hence we have a compression of $\frac{248{,}000}{532}$ = 466 pounds per square inch; consequently the total compression will be 592 + 466 = 1,058 pounds per square inch, and since this is inside of the limit of 1,100 pounds, we conclude that a beam 19 × 28 inches is about right. Of course, we have not allowed anything for the weight of the truss rods, beams, etc., but this can be easily made after all the details have been roughly worked, so that a close approximation of the weight can be made. For any other span the same rules and formulas as given above are used.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Grant's gears, Lex'n, Mass., & Phila., Pa. See p. 11.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Ideal Drawing Stands. M. C. Hammett, Troy, N.Y.

Forming Lathes Mer. Mach. Tool Co., Meriden, Ct.

Air Hoists, Frank Richards, Box 3686, N. Y.

6-Spindle Turret Drills. A. O. Quint, Hartford, Ct.

Milling Machs. Kempsmith M. T. Co., Mil., Wis.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 8 Spruce St., New York.

Drill Presses, with Tapping Attachments.
Gould & Eberhardt, Newark, N. J.

Davis Key Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St., N. Y.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

Pulley lathes, most efficient offered. The Lodge & Shipley Machine Tool Co., Cincinnati, O.

$5 gauge shows speed and all changes of eng's, mach'y, etc. G. T. McL. & Co., 120 Fulton St., Boston.

Air Compressors for every possible duty. Clayton Air Compressor Works, 42 Dey Street, N. Y.

For Cypress Tanks and Vats, address W. E. Caldwell Co., Floyd and Main Streets, Louisville, Ky.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

"Shapers (Double Triple Quick Stroke")
Trade Mark.
Gould & Eberhardt, Newark, N. J.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys Yocum & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Most sensitive and durable Damper Regulator made; works within one pound. Send for circular. T. Kieley, 11 W. Thirteenth Street, New York.

For the Latest Improved Diamond Prospecting Drill address the M. C. Bullock Mfg. Co., corner Canal and Washington Sts., Chicago, Ill.

Improved Duplex and Special Gear Cutters in stock and to order; Gear and Milling Cutters of all descriptions. R. M. Clough, Tolland, Conn.

12-inch breech-loading rifled mortar & mounting, w'ght 118,000 lbs., front Gov't B'ld'g, World's Fair; des'n on applica'n. Builders Iron F'dry, Prov., R. I.

"Pumping Machinery." New book, 450 pp, 8vo, 270 Eng. Prospectus free. W. M. Barr, 3223 Powelton Avenue, Philadelphia, Pa.

Gear Cutters, Auto. Specially adapted for Motor Gears and all other style Gears.
Gould & Eberhardt, Newark, N. J.

Something new in name plates; "oxidized aluminum"; write for sample. Finest castings in the world, made by patent pressure process. Passaic Art Casting Co., 35 Warren St., New York.

Patent Soliciting of High Class.
D. Walter Brown, Counsel in Patent Cases,
111 Broadway, New York.
Send for Brief History of Patent Legislation.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

"Binders" for the AMERICAN MACHINIST. Two styles the "Common Sense," as heretofore sold by us and mailed to any address at $1 00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUBLISHING CO., 203 Broadway, New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

Impressions of the Great Fair.

By permission we make the following extracts from a private letter to the editor, which gives some of our well known correspondent's views in regard to the Columbian Exposition:

In a general way, the Chicago Exposition is big; it is awfully big; and from certain points of view, it is beautiful—beautiful almost beyond comparison in many points. As a picture or a group of pictures it can hardly be rivaled anywhere.

When we reached here May 20th, the Fair was in a stupendous state of incompleteness, only equaled by the crudeness of the art embellishments. An almost inconceivable amount of money has been expended for architectural effects on the exterior of the buildings, and these are undeniably impressive at a distance, but as we approach the approachable that it is all

"make believe" is too apparent. Bears and buffaloes that would be good bears on a mountain, and good buffaloes at long range on the prairies, become blotches when set upon the piers of a bridge ten feet away. When one has seen the architectural display at a distance, he has certainly seen the best of it. It is all, or practically all, outside show. Aside from the Government Buildings, and the Woman's Building, the others inside, compared with the Paris Exposition, are, to say the least, crude, except the Administration Building, which is considered the gem or display piece. There has been made a milk-and-water attempt at decoration on the inside of the Administration Building, but comparing it with the gem of the Paris Exposition, the one is a big barn—a very big barn—made of basswood and whitewashed, compared with the other as a house of mahogany, French polished.

The main buildings, that is, Manufacturers', Mining, Electricity, Transportation Buildings and Machinery Palace, are inside simply whitewashed State Fair buildings, and the whitewash, called paint, put on with a hose, is already rattling off on the exhibits, so that canopies will soon be the rule, as in the French and Spanish sections in the Manufacturers' Building, completely covered, so that when in their sections, nothing is seen of the great roof that protects them from the weather.

The great room in the center of the Manufacturers' Building, the largest by several feet ever seen, does not have that impressive effect or grandeur that so struck one at Paris. The trusses are more numerous, much nearer together, and frail in appearance, compared to the great ribs in the French Machinery Hall. This, I think, could have been greatly improved by the proper use of color, but think of the great spans of iron work left in the regulation iron paint color, with rafters and boards coated with a yellow whitewash squirted on with a hose, compared to the decorated arches, ceilings, tinted iron and terra cotta paneling in the corresponding building in Paris. But it's big beyond comparison; a room that a half-dozen of the largest buildings in New York could stand inside of, is not to be laughed at, and counts awfully in size where size counts. Remember now, when I say it does not equal the Paris roof in grandeur, I also say it's bigger.

Of the hundred or two smaller buildings, nearly all are fine, and certainly those of the States are what the citizens of each State have reason to be proud of as has, too, the government of its building, and its display. The little Puck building is the real gem, and the one thing that reminds one of the Paris Exposition.

The general arrangement of the grounds is on a grand scale, but as yet lacks that which our people do not half seem to appreciate, and that is, gardens and lawns. Large patches of sand and gravel furnishing dust for the winds from the lake to play with, make too much of a nuisance, which lawns help to prevent in two ways—by reducing the amount, and by the grass catching the dust.

The lagoons, besides adding beauty and furnishing pleasant boat rides, give ventilation, with the only drawback, that they make long and tiresome walks from building to building. The rolling chairs, the boats, and the intramural railroad help to a certain extent only.

The facilities for getting to and from the grounds, at least for the present, meet the demands, and will probably for a much larger attendance than has as yet put in an appearance. The 275 hotels, and the 100,000 rooms, within ten minutes of the Exposition grounds, are not one-tenth occupied, nor the innumerable restaurants with bottom price rates troubled by excess of custom.

In fact, it is easy to get rooms within walking distance at a dollar a day, and meals cheaper than in most cities in the country. Now is the time to go and see the show at its best, for although it may be some weeks before all the exhibits are in order, there is more than can be seen and remembered by one person. The ten days we were there showed wonderful progress towards completion. It is better to go now, while there is a chance to see a few things without having to look over a dozen heads, than to view at a distance. Exhibits are cleaner and exhibitors more ready to explain.

Of course you are to go; everybody who can afford it and has the physical strength cannot afford not to go. And as to the sights, if one is so constituted as it seems to me a large majority are, and possesses that spirit which passes for patriotism, believing nothing is done as well elsewhere as here, and nothing right unless done as we do it, he can find abundance for his admiration, and enough, by confining his visits wholly to the American exhibits, to be confirmed in the justice of his convictions. And, too, if he is looking among the foreign exhibits to see what he can find fault with, he can find plenty of that; or if he looks among the machinery to find what has been copied from America, and assumes that all that is like ours has been copied from us, instead of by us, he can find plenty of it.

But there is another side to this question, and that is, how many are there who want to see and learn what other countries can do, and do do, that we do not and cannot do? I know you will, and a few others, but whether there are so few of us that we are simply the cranks, or whether you can put it in some way to get people to look at the work as work, regardless as to who did it, is what one is bound to question after noting what I have seen and heard remarked here and elsewhere.

I have already said so much that I will have to defer telling you of the exhibits themselves until another time.

JOHN E. SWEET.

Hydraulic Portable Riveting Machine.

In our issue of April 20, we illustrated some hydraulic riveting machines, attributing, through a misunderstanding, their manufacture to the Niles Tool Works. This was corrected in our issue of April 27, by placing the credit of manufacture where it belonged, viz., to the Morgan Engineering Company. Since then we have received two letters in relation to this subject which we give below, premising that the first was probably written before the correction referred to above had been noticed by the writer, which accounts for his reference to the wrong company in several places:

Editor American Machinist:

The source of the "Nile" was for many years doubtful. No such doubt can exist as to the source of the illustrations of the hydraulic portable riveting machines made by the "Niles" Tool Works Company, of Hamilton, Ohio, and described in yours of the 20th April last.

I inclose you photographs and woodcuts, many of them fifteen years old, which will, I think, convince you that the Niles Tool Works have "brought out" as their own inventions, very accurate copies of machine tools made on my systems, and I should not have troubled to notice the Niles Tool Company's action—which is after all a very common compliment—"imitation being the sincerest form of flattery," but that the article is so written as to carry the impression that they made all the hydraulic machine tools for the Pennsylvania Railroad Company's shops at Altoona. This is not so, as their machinery was made at Gloucester, England, by Messrs. Fielding & Platt; it is probably because this firm can, to my knowledge, deliver such work into the States, not only as cheap, but, I believe, cheaper than it can be made in the States, that neither their name nor mine has been mentioned in the information given by the Niles Tool Company to you.

Hardly any of the more recent improvements in detail, which have been introduced by Messrs. Fielding & Platt and myself into this class of work are shown in the illustration in yours of the 20th April, for like the Chinese tailor, who when told to copy a pair of trousers did so, holes and all, so I see the Niles Tool Works Company in the illustrations given to you, have copied our wood cuts so closely that a number of details long ago abandoned are shown as new.

Yours obediently,
RALPH HART TWEDDELL.
14 Delahay street, Westminster, London, S. W., England.

Editor American Machinist:

We observe in your issue of April 20, illustrations and description of hydraulic portable riveting machines brought out by the Niles Tool Works Company, Hamilton, Ohio, and also "A Correction" in your issue of 27th ulto.

The hydraulic machine tools at the new shop of the P. R. R, Altoona, were made by us to the order of the Morgan Engineering Company, Alliance, Ohio, who were at that time licensed agents and manufacturers of Tweddell's system in U. S. A.

Yours faithfully,
FIELDING & PLATT.
Atlas Iron Works, Gloucester, England.

Association of Foreman Blacksmiths.

We have received the following with a request that we publish:

GLADSTONE, MINN., June 11, 1893.

At a casual meeting of several foreman blacksmiths, the subject of forming a national association was discussed, and the undersigned were directed to correspond with foreman blacksmiths throughout the country to ascertain their views on the subject.

It is not intended to form a labor organization, so-called, but an association such as that of the master car builders, for mutual information, improvement and benefit.

The suggestion is made that if the proposition is favorably received, a meeting of those who are able to attend be held in Chicago at some convenient date during the World's Fair. To that end will you please write me at your earliest convenience how the proposition strikes you, and, if favorable, whether or not you could attend such a meeting. If a sufficient number of favorable responses are received a meeting will be appointed and notice thereof sent to you.

Yours respectfully,
J. J. THORNTON,
C. H. WILLIAMS,
W. G. LOTIS,
GEORGE F. HINKENS,
Committee.

Please address replies to
GEO. F. HINKENS,
Gladstone, Minn.

"Oxidized" Aluminum Name Plates.

The Passaic Art Casting Company, 35 Warren street, New York, has brought out as an article of manufacture something that, so far as we know, is new in name plates for machinery and other articles. The plates are of "oxidized" aluminum, giving a dark background, while the faces of the letters and other raised parts are bright and may be highly polished if desired. The contrast between the background and the light surfaces is very pleasing. The letters and any designs that may be on the plates cast remarkably fine, making it possible to use the most delicate letters and designs.

MANUFACTURES.

A pulp mill is to be built at Wilmington, Vt.

At Bowie, Tex., C. H. Thompson and George L.

An extract factory is being erected at Bristol, Tenn.

Healey & Brown's factory at Raymond, N. H., will be enlarged.

The Union Wire Goods Co., of Covington, Ky., has been formed.

George West's Mill, Ballston, Spa, N. Y., is to have an addition.

G. P. Clark is to build a mill at Windsor Locks, Conn., 46x50 feet.

The Luger Machine Co., of St. Paul, Minn., has formed, at $50,000.

Southport, Conn, is to have an electric railway from Bridgeport, Conn.

Contracts for a large finishing mill to be erected at Greensboro, N. C., are let.

The Lockport (N. Y.) Paper Company proposes to double the capacity of its plant.

Articles of formation have been filed for the Los Angeles (Cal.) Iron and Steel Company.

The Lookout Boiler Works, of Chattanooga, Tenn., is making additions to its plant.

The Kenning Hardware Co. has been formed at Chicago, Ill., by Charles W. Kenning and others.

The Brooklyn (N. Y.) Tube Bending Company, of Brooklyn, N. Y., has been organized by Ed. E. Tucker.

The mill at Roanoke, Ill., is being repaired, and will be refitted throughout with the latest machinery.

The B. Hoffman Manufacturing Company, Milwaukee, Wis., has been organized, with a capital of $75,000.

The Turnbull & Cullerton Metal Lath Company, of Chicago, Ill, capital stock, $50,000, has been chartered.

The Moswansicut Mfg. Co., of Scituate, Mass., will erect an addition of brick construction 100x70 and two stories.

A. B. Austin, of Fort Wayne, Ind., will erect a new machine shop, a foundry, a boiler shop, and a blacksmith shop.

The works of the Bridgeton Iron Company, of Bridgeton, N. Y., are being enlarged, owing to an increased demand.

Sweeny, Murphy & Hickey, sash manufacturers, have been organized as the Mechanicsville (N. Y.) Manufacturing Co.

The Shamokin Car Works Company, of Shamokin, Pa., contemplate the erection of an additional shop 274x103 feet in size.

At Portsmouth, Va., endeavors are being made to form a $100,000 stock company for the purpose of building a cotton mill.

The Wausau (Wis.) Wagon Supply and Tool Company has been formed, with a capital stock of $100,000, to build a factory.

The Bethlehem (Pa.) and Catasauqua Traction Co. has been chartered. J. K. Page and J. J. Coleman, Allenton, Pa., are interested.

At Franklin, Mass, A. D. Thayer will put up a yarn mill west of his present factory. The building will be two stories high, and 50x90 feet.

The Springfield (Ill.) Canning Works has filed papers with the Secretary of State certifying to an increase of capital stock from $15,000 to $25,000.

The Rome (N. Y.) Locomotive and Machine Works have been formed, with $150,000 capital stock, by Thos. R. Stoyker and Edward Comstock.

Miller & Co., of Brooklyn, N. Y., have been organized to manufacture cigar boxes. Capital, $40,000; and directors G. Miller and H. F. Gebring.

The Roanoke (Va.) Carriage Works have been organized with a capital stock of $25,000. E. R. Spencer is president and G. O. Marshall treasurer.

The Electrical and Mechanical Manufacturing Company, of New York, has been organized. Capital, $15,000, and directors, H. B. Oakman and others.

The Indianapolis (Ind.) Paper-mills Company has been incorporated. The capital stock is $25,000, and the incorporators are J. Lindsay and S. E. Urmston.

The Clearfield (Pa.) Mfg. Co, with capital, $25,000, has formed to manufacture any article from metal; incorporators, T. H. Forcey and P. B. Zentmeyer.

The Portland Dry Plate Company has been formed at Portland, Me. The capital stock is $25,000, and S. G. Cushing is president, and G. L. Fish treasurer.

McAleenan & Co., with $15,000 capital, has been formed at Peoria, Ill., to manufacture boilers and sheet-iron work. Incorporators, Wm. J. McAleenan and brothers.

The Hopkins' Mill, in Ellsworth, Maine, is to undergo thorough repairs. A shingle and other machines will be put in, and part of the building fitted up for a box factory.

The Lookout Boiler Works, of Chattanooga, Tenn., is making additions to its shops on account of increased business. It is buying new tools and machinery to complete the plant.

The factory of the old Pembroke Packing Company, at West Pembroke, Maine, which has been dismantled and idle for several years, is to be refitted and operated by a local company.

The Hausmann Art Metal Company, with capital, $150,000, has organized for the manufacture of metal goods; incorporators: Lincoln Hausmann and H. G. McConnaughty, Philadelphia, Pa.

The Anderson Steel Casting Company has filed articles of incorporation at Indianapolis, Ind., with the capital stock at $100,000. Benj. F. Haugh, Wm. E. and J. A. Kurtz are the incorporators.

In Hammondsville, O., the Wallace Mfg. and Mining Co, with $50,000 capital, has organized for manufacturing fire brick, plows and other agricultural implements. W. H. Wallace is connected.

The Cambridge City Iron Fence Post Company, with $10,000 capital, has organized in Cambridge, Ind., to manufacture iron fence posts. Incorporators, Albert W. Bradbury and Wm. F. Medsker.

The Empire State Paper Company is a new concern, of Mechanicsville, N. Y., to manufacture paper. The capital stock is $30,000, and the incorporators are T. Duncan, of Windsor, Conn., and others.

The Clark Foundry and Iron Company, of Denver, Col., capital stock placed at $50,000, has been chartered to manufacture and deal in iron, steel, etc. J. S. Clark and D. J. Davies, of Denver, are interested.

Ground has been broken at Cumberland, Md., for the new plant of the Cumberland Iron and

Steel Shafting Company. The building will be in the form of two wings, one 180x78 feet, and the other 283x80 feet.

The Barker Mine Car and Foundry Company, of Springfield, Ill., has been incorporated by John W. Black and others, for the purpose of manufacturing car wheels, axles, mining cars, etc. The capital stock is $25,000.

Dean Brothers, manufacturers of steam pumps, at Indianapolis, Ind., have completed plans for their new works. The main building will be 900 feet in length, and 60 feet in width, and will be constructed of brick.

The Brewer Car Axle Box Company has been organized with $5,000,000 capital to manufacture a patent car axle box and journal bearings at Chicago, Ill. Incorporators, Colonel Russell Brewer and A. G. Thompson.

The Elevator Safety Appliance Company, with $20,000 capital, has been organized at Chicago, Ill., to manufacture appliances for self closing and locking elevators, etc. Richard Robins and Jno. J. Hayes are interested.

At Springfield, Ill., the Electric Gas Company, with $1,000,000 capital, has been incorporated to manufacture gas and machine appliances and machinery connected therewith. Incorporators, H. Clay Wilson and others.

The Toledo Bridge Company, of Toledo, Ohio, is putting up an additional building, 250x90 feet, which will be equipped for turning out all kinds of heavy iron building material. Heretofore the company has confined itself to bridge work alone.

The Newburn Brick Works Company has been incorporated to manufacture brick at Newburn, a small village eight miles from Jerseyville, Ill. The capital stock is $150,000 and the incorporators are W. W. Courtney, G. H. Smiley and Levi Davis, Jr.

There is water-works agitation at Lebanon, Ind., Falmouth, Ky., Winton Place, O., Pasco, Wash., Boston, Mass., Kingfisher, Okla; Newburg, N. Y.; Ottawa, Ont; Lebanon, Pa; Buffalo, Wyo.; Bangor, Me.; Columbus, O.; Orrville, O.; Lockport, N. Y.

Reeves Brothers, of Niles, O., manufacturers of boilers and rolling-mill machinery, have begun work on their new plant at Alliance, O. The first building to be erected will be a 90x200 foot boiler shop, and when this is well started a 70x200-foot tank and gas-holder shop is to be started.

The Diamond Publishing Company has been formed in Rockland, Maine, for the purpose of publishing a daily and weekly newspaper, and the carrying on of a general job printing office. The capital stock is $10,000, and the officers are E. R. Chaples, president; Frank B. Miller, treasurer; E. R. Chaples, A. A. Beaton and F. B. Miller, directors.

The Pioneer Paper Stock Company at Chicago will build at once a brick building of four stories and basement. It will be 100x110 feet, and will be fitted with fire-proof doors, etc. It will be used principally for storage, which will allow their present spacious building to be used for sorting and grading purposes. This is one of Chicago's active and progressive concerns.

Corinna, Maine, is hoping to get a woolen mill this year. Some experienced manufacturers propose to erect a four set mill there if certain conditions are complied with, one of said conditions being that the citizens subscribe $1,000. At last accounts nearly all of the money had been raised. There are three good water privileges in Corinna, and if they were properly improved and utilized, the village would soon develop into a smart and prosperous town.

Much of the stock required for the establishing of the proposed carpet factory in New Bedford, Mass., is reported as subscribed. It is proposed to erect a two-story brick building, and equip it with 100 looms for the manufacture of carpets. The building will be 250x90 feet, and a 250 horse-power engine will be required to furnish power. The owners of the plant desire to incorporate, with a capital of $850,000, and $150,000 of the capital stock will be offered New Bedford citizens.

The Union Foundry and Machine Co., Pittsburgh, Pa., have issued edition "E" of their catalogue on gearing, winding drums and sheaves. The catalogue is a new one, and condensed so as not to take up unnecessary space. The list of gears is a large one. In the introductory is an explanation of their system, and at the close are several sheets of perforated order pages, which will prove very acceptable to those ordering gears. The catalogue contains "A Practical Talk On Gearing," which is instructive; also tables of horse-power, a "calculating" table, key for ordering gearing, etc. It is sent free on application.

The Watts-Campbell Co., Newark, N. J., are busy, their work being largely in compound engines. Amongst other engines under construction are a 2,700 H. P. triple-expansion for Fall River, Mass., Iron Works; 1,500 H. P. compound for Shore mills, Fall River, Mass.; 1,500 H. P. compound for Granite-mills, Fall River, Mass.; 1,000 H. P. compound for King Phillips mills, Fall River, Mass. 1,000 H. P. compound Mohawk mills, Utica, N. Y.; 750 H. P. compound for Utica Steam-mills, Utica, N. Y.; 750 H. P. compound (third order,) Trenton Pass. R. R., Trenton, N. J; 300 H. P. Wissahickon Pass. R. R. Co., Wissahickon, Pa.

Machinists' Supplies and Iron.

NEW YORK, June 17, 1893.

Iron—American Pig—We quote Standard Northern brands, No. 1 Foundry, $14.50 to $15.25; No. 2, $13.50 to $14.25; Gray Forge, $12.25 to $12.50. Southern brands of good quality are obtainable at $14.25 to $14.50 for No. 1 Foundry; $12.75 to $13.50 for No 2 and $11.75 to $12.50 for Gray Forge.

Antimony—The market is steady. We quote L. X., 10¼c. to 10⅜c.; Cookson's, 10½c. to 10¾c.; Hallett's, 9⅝c. to 9.95c., and U. S. French Star, 10½c.

Copper—On account of the financial situation the market is dull, and prices are practically unchanged. Lake Copper is quoted at 10.85c. to 11c. Casting Copper is held at 10c. to 10⅛c.

Lead—Prices continue to drop, but buyers are holding off. Bids are solicited, and it is claimed that 3.70c. would buy and probably a trifle less.

Lard Oil—Prime City is quoted at 75c. to 76c.

Spelter—The market is nominal at former prices, 4¼c for New York delivery.

Tin—Prices seem to be on the advance; business is reported at 20c. to 20.05c. for spot, 20.10c. for June, and 20.25c. for July.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

A first-rate mach., of long exp., wants a steady position. Best refs. BOX 1, AMERICAN MACHINIST.

Wanted—Exp'd men on horizontal boring machines. Address Box 5, AMERICAN MACHINIST.

Wanted—Position as foreman boiler maker; 12 yrs'. exp.; ref. A1. A. M P., Box 92, Roanoke, Va.

Draftsman, designer, supt; 7 years' exp., wishes change. A1 ref. Address "G. P.," AM. MACH.

Machinist—Young man 19 years old, 3 years' exp., want situation. Address P. J., AM. MACH.

Mechanical draftsman, exp'd, good designer, shop practice, wants position. L. C., AM. MACH.

Wanted—Position by young draftsman, with good exp.; references. H. C., Box 8, AM. MACH.

Draftsman experienced on machine tools, desires position. C., Box 47, AMERICAN MACHINIST.

Wanted—Permanent position by first-class mech. draftsman, age 25. Reliable, AM. MACHINIST.

A first class diemaker and machinist desires position. A1 refs. Address Box 11, AM. MACHINIST.

Wanted—Position as foreman or supt.; used to close interchangeable work; can design tools. Address Box 46, Simsbury, Conn.

Pract. & progressive machinist (age 30) wishes to change about July 15. Pos. as foreman pref'd; for particulars, address "Keystone," AM. MACH.

Wanted—Position at designing metal-working machinery, jigs and fixtures, or as sup't by a mechanical engineer; age, 35. Buckeye, AM. MACH.

Wanted—Situation by exp'd pattern maker on plumbers' & steam fitters' work; 15 years with leading firm; refer to present employer. M. M. AM. MACH.

Wanted—Position as foreman of shop mfg. paper-mill machinery, or paper-mill repairs; West or South preferred. Address Hustler, AM. MACHINIST.

Wanted—Position as draftsman and designer by energetic progressive mechanic of prac. exp. and theoretic education. R. J., AMERICAN MACHINIST.

Pattern Maker Wanted—Steady job for good all around man. State experience, and wages wanted. Address Machine Shop, AMERICAN MACHINIST.

Young Norwegian, graduate of technical college, and with some practical exp., wants pos. as draftsman. Salary moderate. A. Z., AM. MACHINIST.

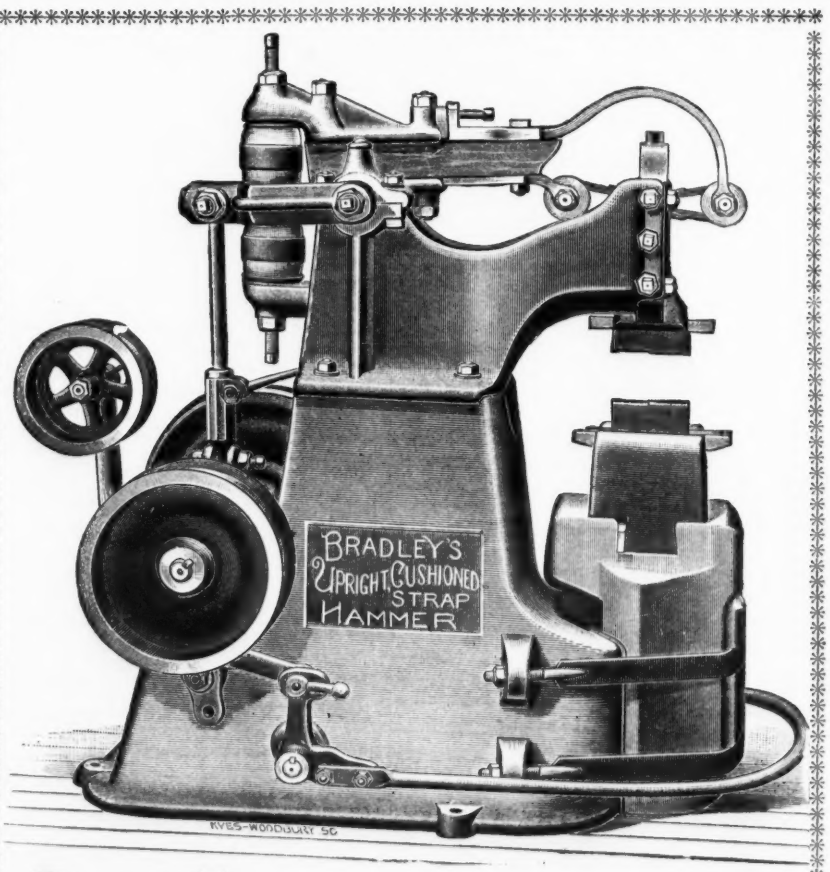
Wanted—Foreman blacksmith on machine tool work; must be well posted on piece-work. Address Box 4, AMERICAN MACHINIST.

Wanted—1st-class vise and floor hands of large experience; must be sober and industrious. Can secure steady employment. Married men preferred. Morgan Engineering Co., Alliance, Ohio.

Machinist wanted with some capital, to join young man with established foundry business; a good business can be built up; must be of good character. Address Box 10, AM. MACHINIST.

Open for engagement, a young man who has had 10 years' experience as foreman and superintendent of a shop employing 150 hands, doing general machine work. Address X. X., AM. MACHINIST.

Wanted—Level-headed mechanic to take charge of small mach. shop. Chance for right man to grow. Say what you have done, and compensation expected. Address "Good Place," AM. MACHINIST.



Bradley Hammers.

If you plate, draw, square, taper or weld iron and steel, you need a Bradley Hammer.

If you swage, collar, spindle, or do any manner of die work, a Bradley Hammer will soon pay for itself.

That the Bradley is the best Power Hammer in the market has never been questioned. Our circulars illustrate, describe, give sizes and prices.

BRANCHES: 14 Warren St., New York. 96-98 Sudbury St., Boston.

BRADLEY & COMPANY, Syracuse, N. Y.

THE MASON LEVER VALVE

Is made essentially the same as the "Mason Balanced Valve," with the substitution of yoke and lever with weight attached for the bonnet and knuckle joint of the balanced valve. The lever valve will be found useful in controlling the supply of water in tanks by attaching to a ball float. It can also be used to control steam pumps in tank service, by placing the valve in the steam supply pipe to the pump and connecting the lever with a ball float placed in the tank. There is no lost motion in any of the joints, a fact which those desirous of close regulation will appreciate. These valves can be furnished either as piston or seated valves. The latter style is steam tight.

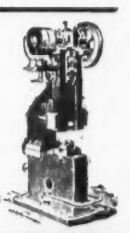
MASON REGULATOR CO.,
BOSTON, MASS., U. S. A.

OUR NEW CATALOGUE
—OF—
TEXT BOOKS AND INDUSTRIAL WORKS
Will be sent Free by Mail to any one writing for it.
JOHN WILEY & SONS,
SCIENTIFIC PUBLISHERS, NEW YORK.

Ready Made Cut Gears.
Ready Made Cast Gears.
Ready Made Brass Gears.
Gears Made to Order.
Gear Cutting.
Gear Book, 15 cents.
Treatise on Gears, $1.00.
Gear Cutting Machines.
GEORGE B. GRANT,
Lexington, Mass.,
and 125 South 11th St.,
Philadelphia, Pa.

HACKNEY HAMMERS

Meet all requirements more fully and satisfactorily than any other of its competitors.
INVESTIGATION IS NOT COSTLY.
INVESTIGATION IS CONVINCING.
WRITE FOR CATALOGUE TO
THE HACKNEY HAMMER CO.
20 Johnson St., CLEVELAND, O.



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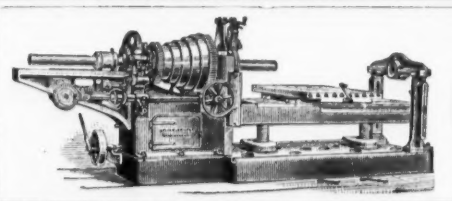
Friction Pulleys, Clutches and Elevators,
PROVIDENCE, R. I.

CHARLES MURRAY
ENGRAVER ON WOOD
58 ANN ST. NEW YORK.



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WILMINGTON, DEL.
MACHINE TOOL BUILDERS.
IMPROVED PATTERNS! LATE DESIGNS!
Chicago Office: 14 South Canal St.

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ASBESTOS
ASBESTOS SECTIONAL PIPE COVERINGS.
Non-Conducting Coverings for Steam and Hot Water Pipes, Boilers, etc.
ASBESTOS BOILER COVERINGS.
H. W. JOHNS MANUFACTURING COMPANY,
H. W. Johns' Asbestos Millboard, Sheathings, Building Felts, Fire-Proof Paints, Liquid Paints, Asbestos Roofing, Etc.
87 MAIDEN LANE, N. Y. JERSEY CITY, CHICAGO, PHILADELPHIA, BOSTON, ATLANTA, LONDON.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Wanted immediately—A man to start and take charge night turn in machine shop. About 10 men at first. Good place for good man. Address Box 3, AMERICAN MACHINIST.

Wanted—Foreman blacksmith. Shop has 26 fires, 2 large steam hammers. Must be first class man. State refs., and wages expected, Bucyrus Steam Shovel and Dredge Co., South Milwaukee, Wis.

Wanted—An all around machinist; one accustomed to factory repair work, and to work on new machinery. Good position to right man. Address The Wabash Screen Door Co., Rhinelander, Wis.

Shop agents for Carr's surface gauge and key rule clamps; liberal discounts; send for circulars; 2,000 gauges sold in past six months The Hoggson & Pettis Mfg. Co., New Haven, Conn.

Wanted—Position as foreman of foundry; well up in all foundry practice; have had large experience in the handling of men; strictly temperate; the best of references. Address Box 9, AMERICAN MACHINIST.

Wanted—Machine shop, also foundry foreman for printing press works. Applications of competent, exp'd men in this line considered only. State age, where last employed, how long, and in what capacity. Address Jno. J. Clause, Elkhart, Ind.

Wanted—A foundry foreman; must be a man of experience who is capable of producing the highest class of machinery castings; cylinders a specialty; give references, age, experience and salary expected. Address Box 136, AMERICAN MACHINIST.

Draftsman (designer) wants pos., tech. graduate, 5 yrs' mach., 8 draftsman, and two had charge of drafting room (10 men). Exp'd on jigs and fixtures, light and heavy mach. tools, hyd. cranes, gen. mach'y. Box 140, AMERICAN MACHINIST.

Wanted—A practical mach. or pattern maker who is a capable draftsman One who has had some exp. in designing special machines and tools for making iron and brass valves, steam fittings, etc., pref'd. Address Box 139, AM. MACHINIST.

Wanted—Situation as supt. or foreman of machine shop, any class of work. Have had 20 yrs' exp., and have been in present situation on electrical work of every description for 12 yrs. Highest of refs. furnished. J. H., AMERICAN MACHINIST.

Wanted—As instructor, an M. E. graduate with 3 yrs' exp. in the designing of machinery and in testing of steam plants; must be able to begin work Sept. 13. Address application and references to Prof. Mech'l Eng'g, 357 Market st., Bethlehem, Pa., stating past experience and salary expected.

MISCELLANEOUS WANTS

Advertisements will be inserted under this head at 25 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd lathes & planers S. M. York, Clev'd, O.

Best Steel Flue Scrapers. Kelley Co., Erie, Pa.

Punch & Drop Presses. Am. Tool W'ks., Clev., O.

For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Co., Cincinnati, O.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

Agent wanted to raise club in every shop. Money in it; write quick, Scientific Mach., Cleveland, O.

Massive drill press, 35" swing, $65; Monitor, lathes, 15" & 30" swing, $75. 229, AM. MACHINIST.

Wanted—Party to furnish tools and money to perfect a steam pump, the result of practical experience. Address Box 149, AM. MACHINIST.

We will pay 50 cents each for copies of the AMERICAN MACHINIST of December 4, 1886 issue; must be unsoiled and in good condition. AMERICAN MACHINIST PUBLISHING COMPANY, 203 Broadway, New York.

SECOND-HAND MACHINERY.

SCREW-CUTTING LATHES.

1 13 in. x 5 ft. Phoenix Iron Works, Rise and Fall Rest.	Cheap; Good order
1 16 in. x 6 ft. New Haven Rise and Fall Rest.	A order
1 16 in. x 7 ft. Bement, Plain Rest and Chuck; fine tool.	A1 order
1 15 in. x 8 ft. Jones & Lamson, Rise and Fall Rest.	Good order
1 16 in. x 6 ft. Blaisdell, Rise and Fall Rest.	Good order
1 17 in. x 6 ft. Fitchburg, Compound Rest fine tool	Good as new
1 18 in., raised to 36 in. x 9 ft. Michigan Tool Works, Plain Rest	A1 order

PLANERS AND SHAPERS.

1 16 in. x 16 in. x 3 ft. Belden & Co. Planer.	A1 order
1 20 in. x 20 in. x 5½ in. Pratt & Whitney Planer.	A1 order
1 20 in. x 20 in. x 4 ft. New Haven Planer.	A1 order
1 30 in. x 30 in. x 8 ft. Hewes & Phillips Planer, fine tool.	Good as new
1 40 in. x 36 in. x 10 in. New Haven Planer bargain.	A1 order
1 6 in. Boynton & P. Crank Shaper.	A1 order
1 15 in. Juengst Friction Shaper, with Vise,	Good order
2 24 in. Hendey Friction Shapers, complete.	Good order

MISCELLANEOUS.

2 Garvin No. 1 Gear Cutters,	Good as new
1 Brown & S. No 1 Universal Miller, complete.	A1 order
1 Garvin No. 5 Heavy Miller, Late Pattern.	A1 order
1 Garvin No. 2 Two-spindle Drill Press.	Good order
1 Garvin No. 3 Four-spindle Drill Press.	Good order
1 Barnes Friction Disk Drill Press.	Good as new
1 10 in. Slate Sensitive Drill Press.	Good order
1 24 in. Dexter Drill, Back Geared, Power Feed.	Good as new

A lot of Grinding Machines, Power Presses, Foot Presses, Shears &c.

700 New and Second-hand Tools in stock. Write for complete list, Photographs and Prices,

THE GARVIN MACHINE CO.,
LAIGHT & CANAL STS, NEW YORK

SECOND-HAND AND NEW MACHINERY

84x84x16½ ft. Planer. Niles Tool Works, three heads.

Planers.	62 in x22 ft.	Planers.	25 in.x5 ft.
"	42 in.x16 ft.	"	24 in.x5&6 ft.
"	36 in x12 ft.		24 in.x4 ft.
"	31 in.x8 ft.	"	22 in.x5 ft.
"	26 in.x7 ft.		

80 in.x18 ft. Engine Lathe Geared Face Plate.
60 in.x45 ft. Double Engine Lathe.
52 in.x35 ft. Engine Lathe Horizontal Boring Machine, one end.
30 in.x28 ft. Pond Machine Tool Co. Shafting Lathe.
36 in.x16 ft Engine Lathe.
33 in.x27 ft. " "
32 in.x12, 14, 16, 18 ft. Bed. New Engine Lathe.
28 in.x22 ft. Engine Lathe, cheap.

25 in.x12, 16, 20 and 24 ft. Bed	New	do	do
21 in.x10, 12 ft.	Bed.	do	do
20 in.x 5, 6, 8 & 12 ft.	do	2d Hand	do
18 in.x 6, 7 & 8 ft.	do	New & do	do
17 in.x 8 ft.	do	do	do
16 in.x 6 & 8 ft.	do	do do	do
15 in.x 6 & 8 ft.	do	do do	do
14 in.x 6 ft.	do	do do	do

Car Axle Lathe, Bement. | Driving Wheel Lathe 88 in.
15, 16, 18, 25 in. Crank Shapers. | Wheel Quartering Mach.,
20, 24, 26 & 30 in. Geared Shapers. | Double eight and left hand.
20, 22 24, 28, 30 & 36 in Drills. | No. 0 Turret Lathe,
Bolt Cutters. | Am. Tool and Mach. Co.,
8 and 1 13 in. Stroke Slotters. | 24 in. Swing, 8 ft. Bed.
Lot of Lincoln Pattern Millers and No. 1 P. & W. Millers.
2 Spindle Drills. Garvin.
Gear Molding Machine. Stamping Press, Bridgeport.
1100 and 3000 lb. Bement Steam Hammer.
100 lb. Steam Hammer. | SEND FOR
40 H. P. Vert. Engine. N. Y. S. S. P. Co. | MAY LIST.
11 in.x18 in. Hor. Engine. A1 Order.
16 in.x42 in. Corliss and 16 in.x48 in. Brown Eng.
300 H. P. Westinghouse Comp'd Engine.

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120 BROADWAY, NEW YORK.

MACHINE DESIGNING, MECHANICAL DRAWING, Patent Office Drawing, Print Copies of all kinds and sizes. Lowest prices consistent with good workmanship. Correspondence solicited.
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Room 442 Butler Exchange, PROVIDENCE, R. I.

MACHINE TOOLS

NEW AND SECOND-HAND.

ENGINE LATHES.

13 in.x 6 ft.,	Complete. Cpd. Rest and Cross Feed	Improved style
14 in.x 6 ft.,	do	Prentice, Hendey and Fitchburg
16 in.x 6 ft.,	do	Hendey Fitchburg and Prentice
16 in.x 6 ft.	do	Bridgeport Mach. Tool Works. Good order.
16 in.x 8 ft.,	Improved style. Cpd. Rest and Cross Feed.	
18 in.x 8 ft.	Complete. Horton's. Improved style. "New features."	
20 in.x 8-10 ft.,	do Cpd. Rest and Cross Feed.	
22 in.x10-12 ft.,	do Improved style. Ex. heavy.	
24 in.x12-14 ft.,	do do do	
28 in.x16 ft.,	do do do	
30 in.x18 ft.,	do Old style. Fair order. Cheap.	
43 in.x 16 ft.,	Triple geared. Cpd. Rest, Cross Feed and Full Swing Chuck. A1 Order.	
96 in.x 16 ft.,	Triple geared, 84 in. Face Plate. Good order.	

PLANERS.

22 in.x 5 ft.,	Complete, with Chuck, Putnam.	A1 order.
24 in.x 6 ft.,	do	New Improved style
28 in.x 6 ft.,	do	Putnam Good order.
28 in.x 6 ft.,	do	Good order. Low Price.
30 in x10 ft.,	do	Modern style. Ex heavy. A1. order.
36 in.x12 ft.,	Extra weight and power.	Powell Planer Co.

SHAPERS.

8 in. Stroke.	Crank.	Good order.	Gould
9 in.	do do	Extra heavy.	Hewes & Phillips
13 in.	do do	do Good order.	
14 in.	do do	Trav. Head. Improved style.	Fitchburg
15 in	do do	"New Improved Style."	
22 26 in	do	Triple Geared. Improved.	

MISCELLANEOUS.

Radial Drills, 3, 4, 5 and 6 ft. Arms. Improved.
Upright Drills, 20 21, 25 and 32 ins. Prentice.
Upright Boring and Turning Mill 38 in. A1.
Brown & Sharpe Vertical Turret Machine No. 2. A1 order.
Universal Milling Machine, Improved style. "New features."
Milling Machines. Standard sizes. Improved style.
Lincoln Milling Machine. With Vise. Good order.
Bliss Vertical Milling Machine, 54 in. between housings. Extra heavy for Face Milling. A1 Order.
Screw Machine 15 16 in. Back gears Auto feed, Chuck and Tools Complete, Jones & Lamson. A1 order.
Boiler Bending Rolls, 8 10 ft. "Improved style." Hinged housing

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E. P. BULLARD'S N. Y. Mach'y Warerooms.
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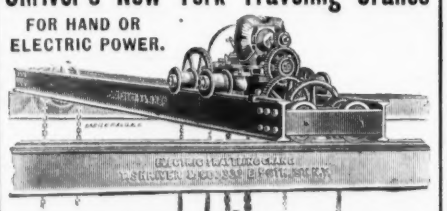
FOR HAND OR ELECTRIC POWER.



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MANUFACTURERS OF
TRAVELING CRANES of 1½, 2, 3, 5 and 10 Tons capacity, to be operated by Hand, or **wholly** or **in part** by Electricity.

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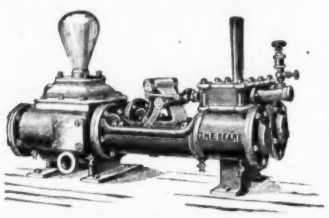
Book on Gears, 170 Illustrations, $1.00. Job Gear Cutting of all kinds. Spur, Bevel, Spiral, Ratchet, Worm-Rack, Elliptic, Index Plates, Noiseless Fiberoid Gears, etc Very small or large. Send for Catalogue. 1100 sizes of Gears.



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OF HOLYOKE
STEAM PUMPS
DEANE STEAM PUMP CO.,
HOLYOKE, MASS.

CRESCENT STEEL CO.
PITTSBURG, CHICAGO, NEW YORK.

STEEL FOR Lathe and Planer TOOLS, Cold Chisels, Punches & Dies, Milling Cutters, Molding Bits, &c. | SHEET STEEL, POLISHED Drill Rods, SPRING STEEL, Machinery Steel, COILED SPRINGS, Steel Forgings, ETC.

A NEW SCREW PLATE.

THE HANDIEST PLATE MADE.
THE FULL MOUNTED LIGHTNING.

These Plates have a stock with each die. The dies are our celebrated Adjustable **Lightning** Dies. Each Stock is of correct length and weight to suit size of die. Several sizes of dies may be in use out of same set at same time. SEND FOR CATALOGUE. Made by

WILEY & RUSSELL MFG. CO.,
GREENFIELD, MASS., U. S. A.

"R. MUSHET'S SPECIAL STEEL"

SAVES LABOR in being able to run at GREATLY INCREASED SPEEDS. FEWER GRINDINGS. No WASTE in redressing.
SOLE REPRESENTATIVES IN THE UNITED STATES,
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SEBASTIAN LATHE CO.
117 & 119 Culvert St., Cincinnati, O.

Manufacturers of Foot and Power

ENGINE AND SPEED LATHES,
For General Machine and Jobbing Shop, Electrical and Experimental Work.

DEALERS IN MACHINISTS' TOOLS AND SUPPLIES.

JESSOP'S STEEL

FOR TOOLS, DRILLS, DIES, &c.

ALL KINDS IN STOCK.
Manufactory, SHEFFIELD, ENG.
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WM. JESSOP & SONS, LD.
Established a century ago.

THE BEST WORKMEN ARE USING

GROBET SWISS FILES.

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105 FULTON STREET, NEW YORK CITY.

FOR SALE.

On account of retirement from business, the following Second-hand Machine Tools at very low prices: One 50 inch Pulley Lathe, one 60-inch Boring Lathe, one Shafting Lathe, one Shafting Straightener, one large Drill Press, one Gear Cutter, five Lathes, two Emery Grinders. All the above in the very best condition and open to inspection at any time. Send for descriptive list and prices.

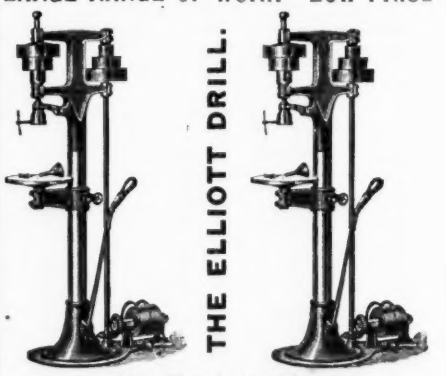
QUEEN CITY MACHINE WORKS,
P. W. REINSHAGEN, Prop.,
87 and 89 East Eighth St. Cincinnati, O.

BURNHAM'S DRILL.

SEND FOR CIRCULAR.
THE GEO. BURNHAM CO., Worcester, Mass.

The Elliott Drill Press
FOR ANY LIGHT WORK

LARGE RANGE OF WORK - LOW PRICE



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A. J. WILKINSON & CO.,
180 to 188 WASHINGTON ST., BOSTON, MASS.
SEND FOR CATALOGUE.

Flexible Metallic Fillet

For Pattern Makers. 8 Sizes.
H. WHITE, 44 N. 4th St. Phila. Pa.

MOFFET PORTABLE DRILL.

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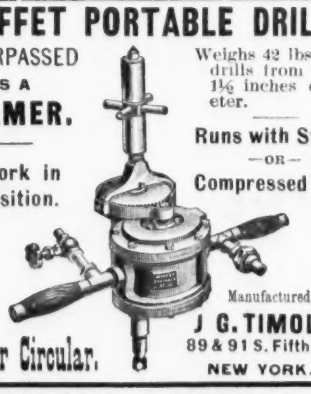

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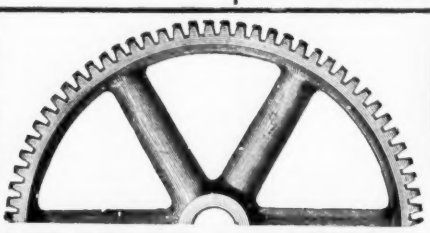

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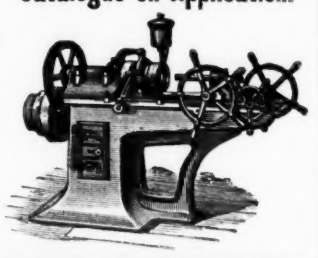

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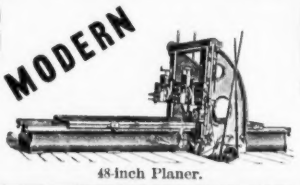

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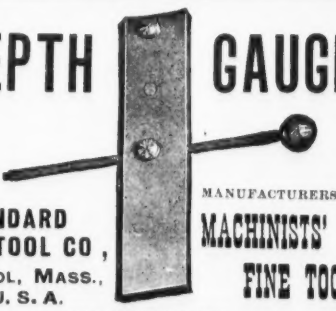

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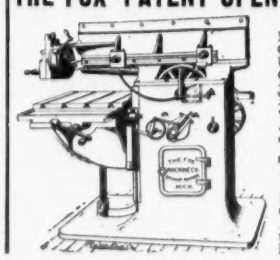

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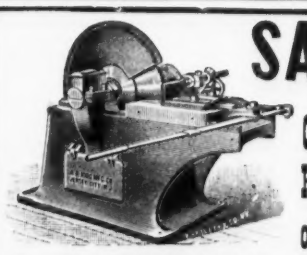

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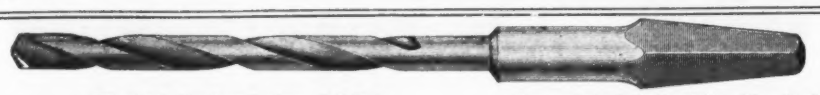

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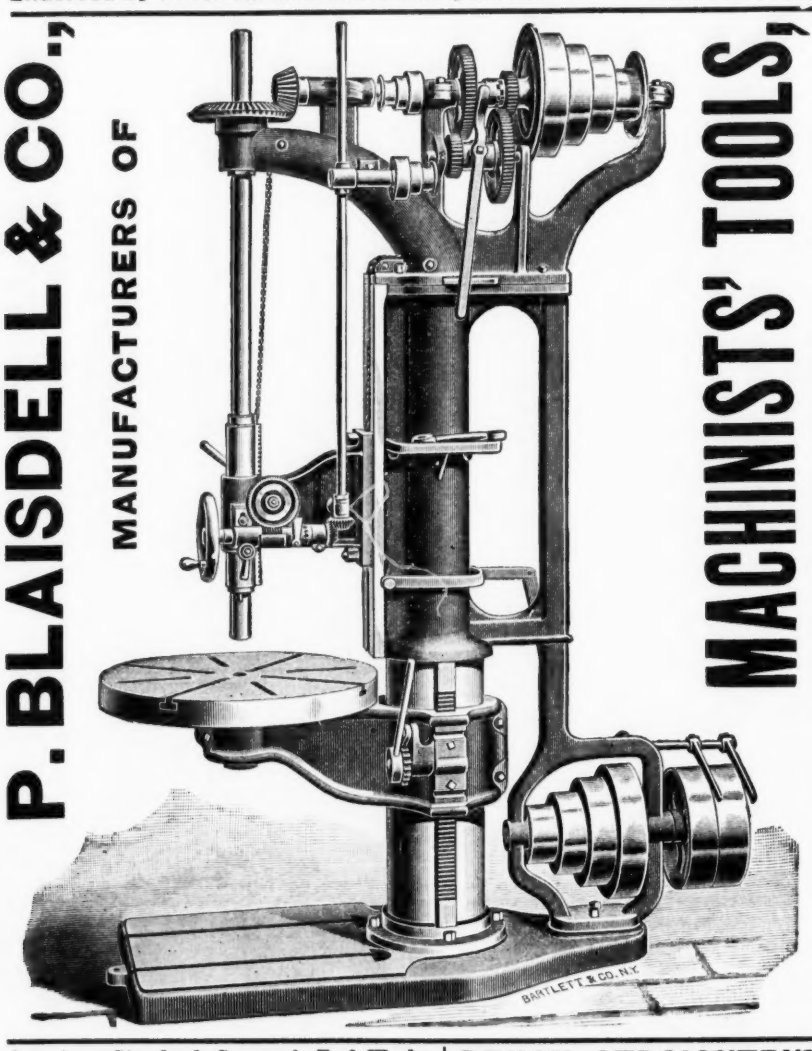

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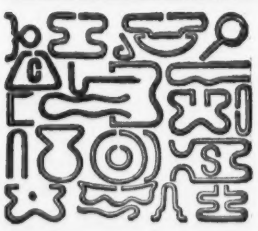

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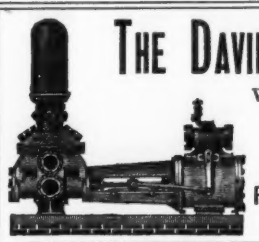

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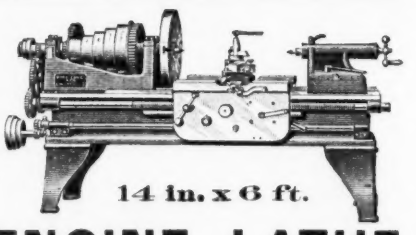

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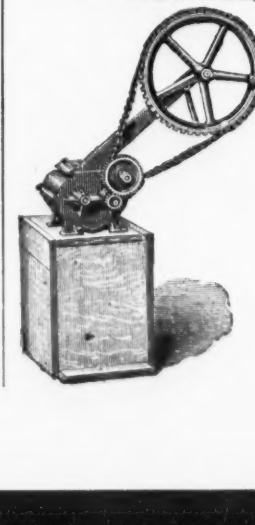

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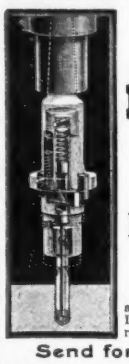

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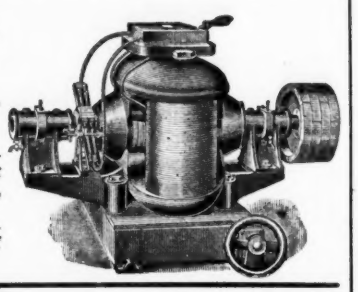

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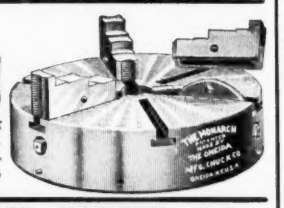

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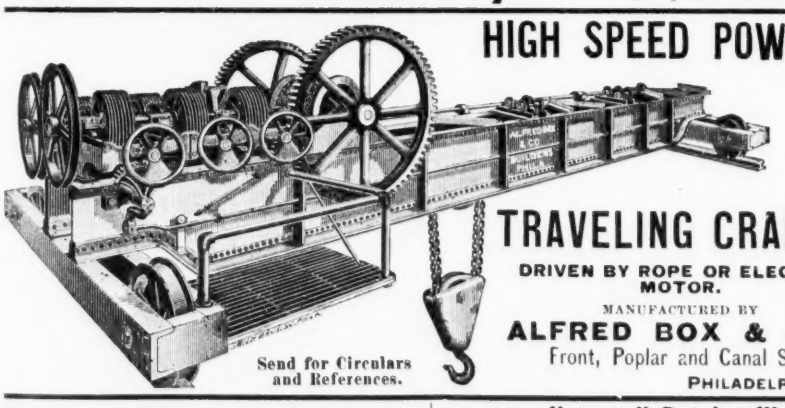

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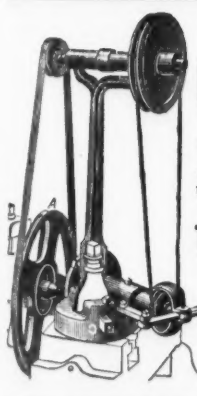

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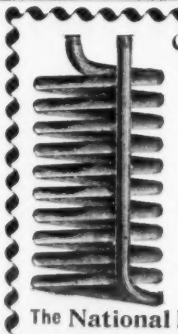

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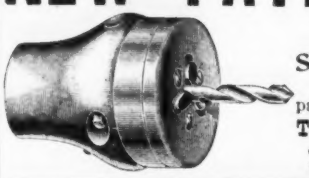

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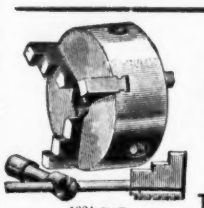

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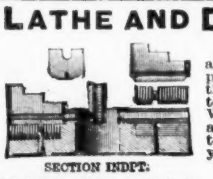

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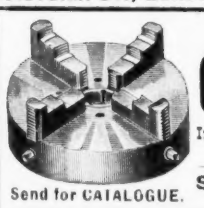

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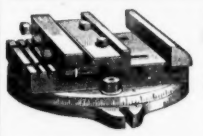

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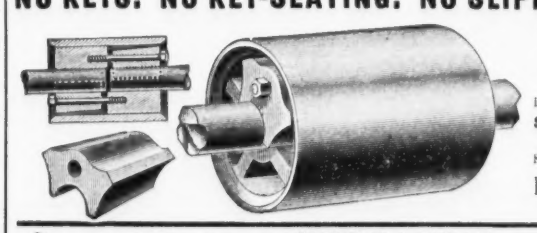

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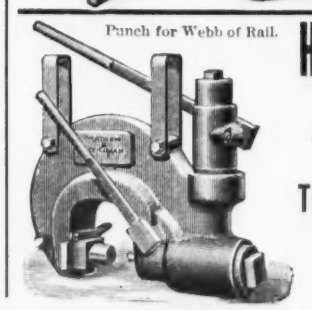

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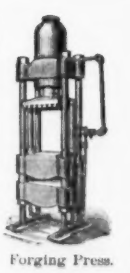

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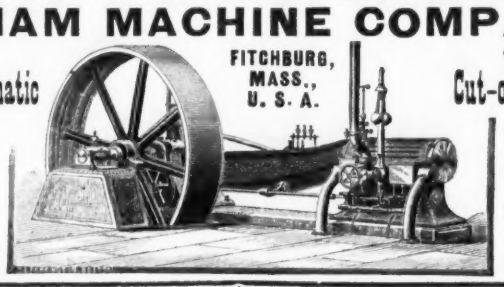

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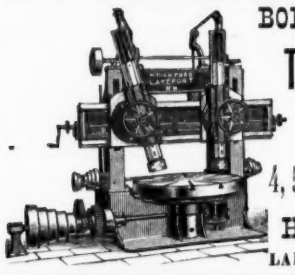

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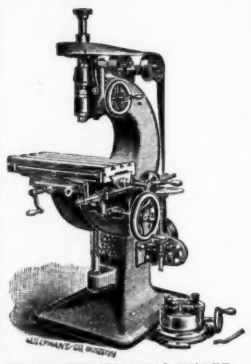

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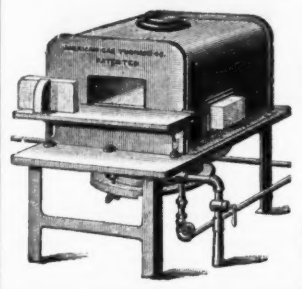

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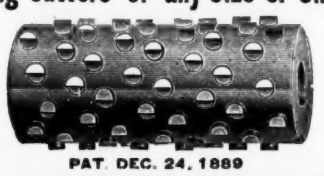

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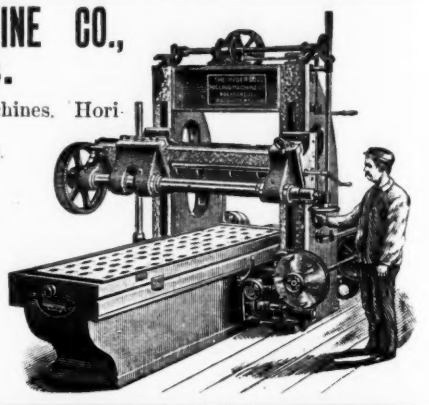

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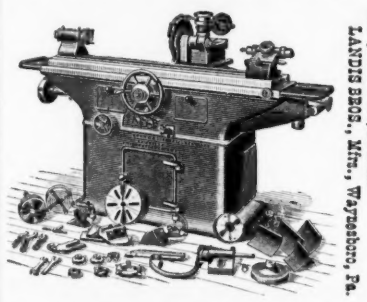

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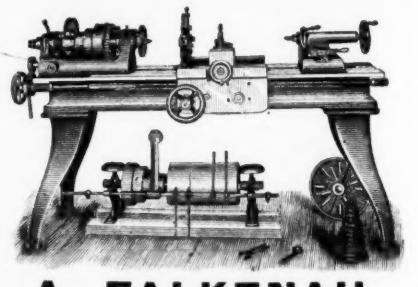

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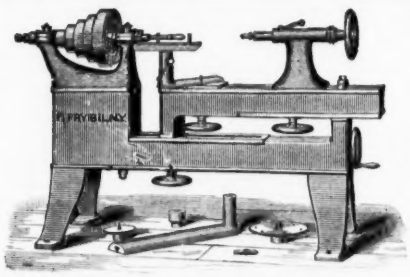

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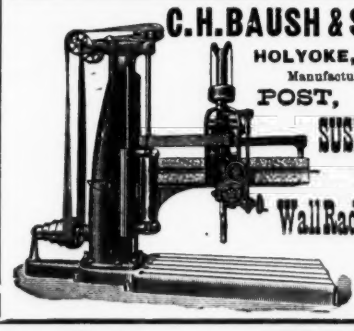

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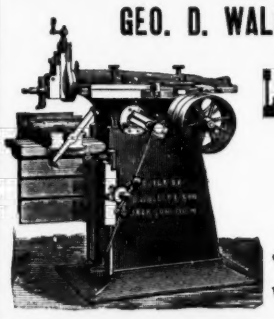

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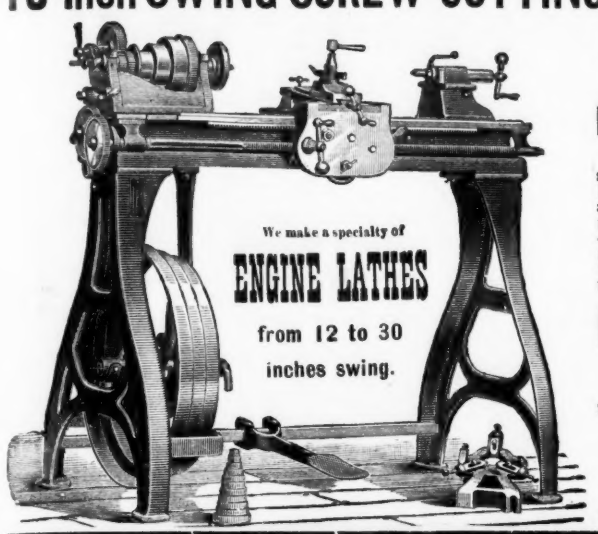

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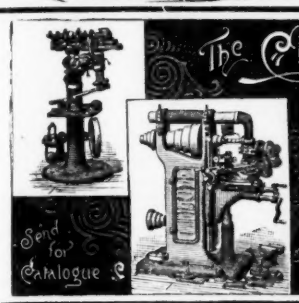

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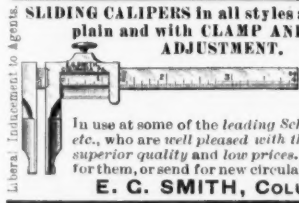

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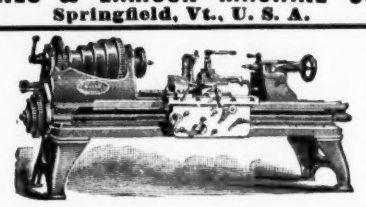

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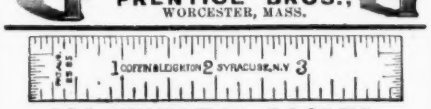

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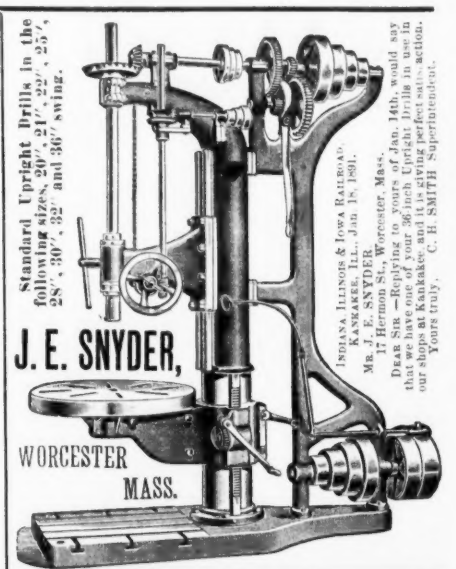
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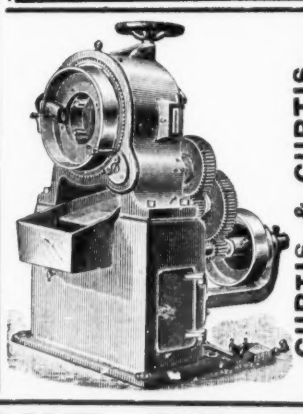

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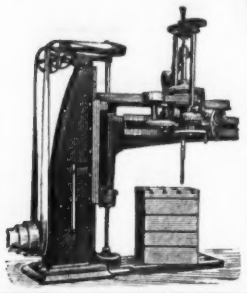

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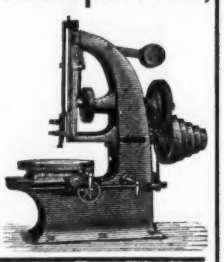

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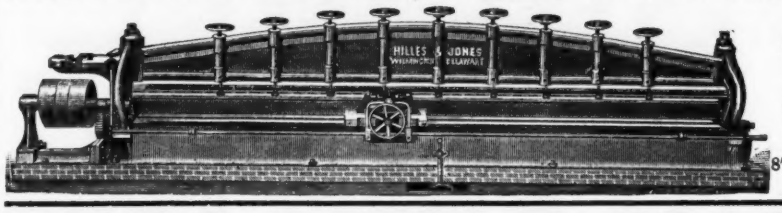

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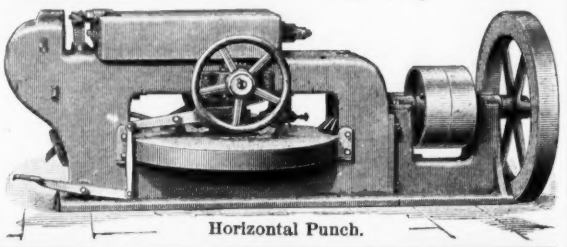

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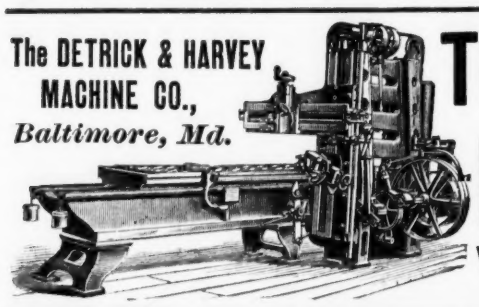

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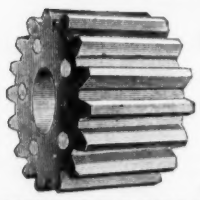

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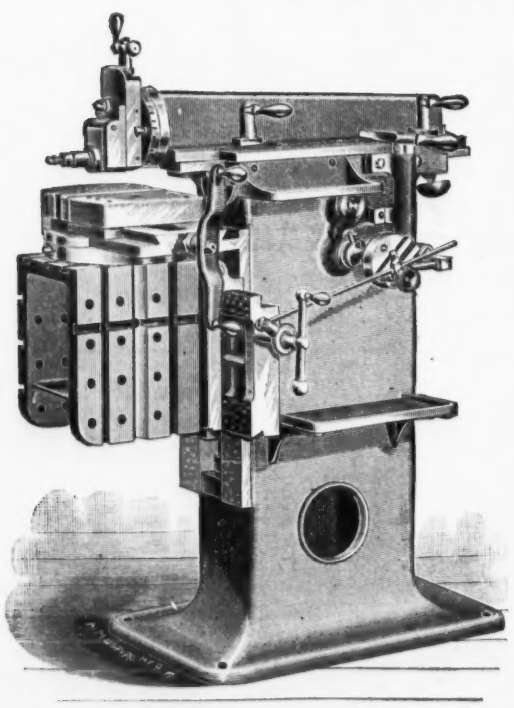

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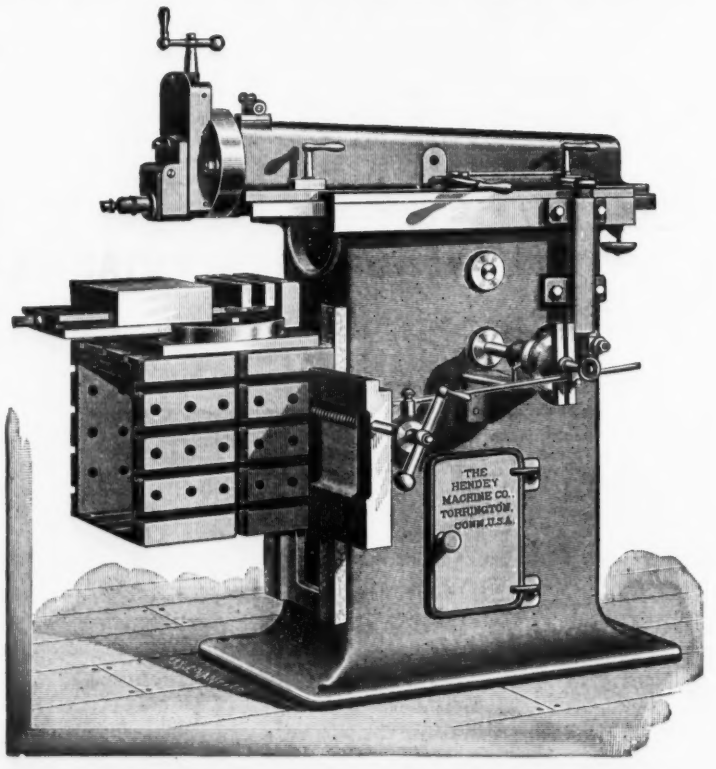

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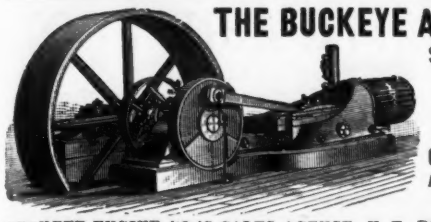

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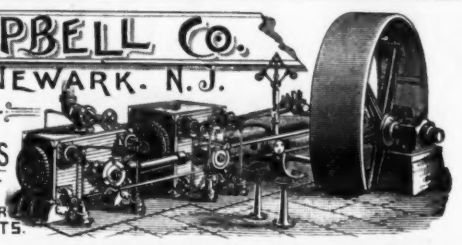

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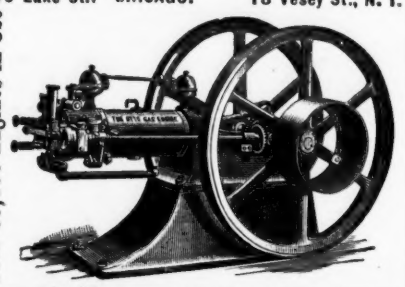

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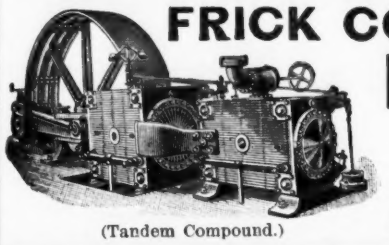

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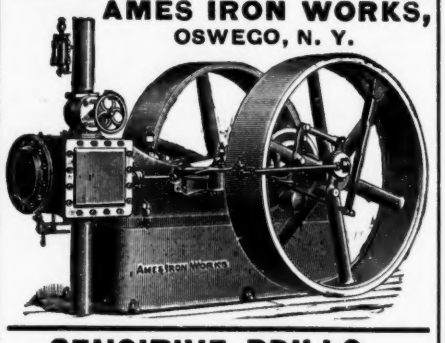

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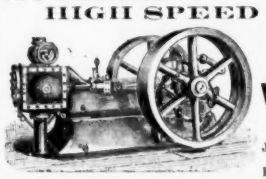

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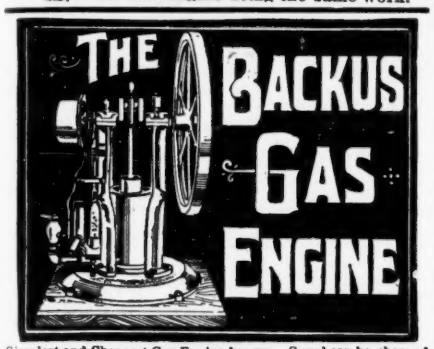

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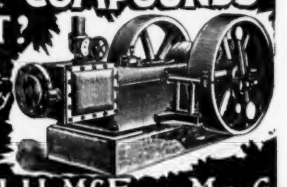

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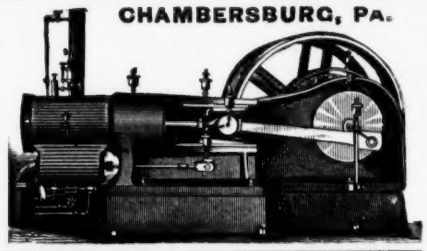

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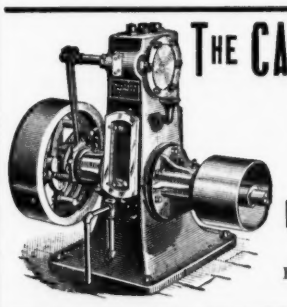

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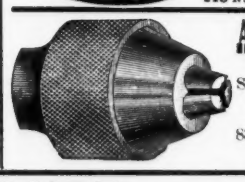

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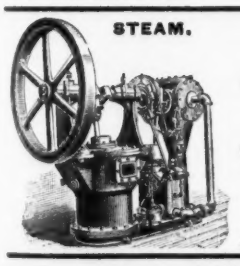

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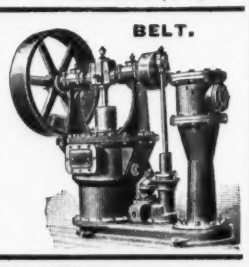

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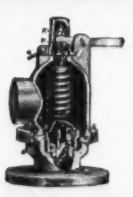

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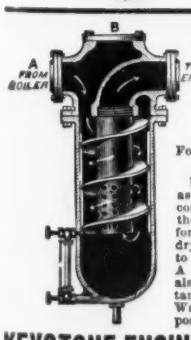

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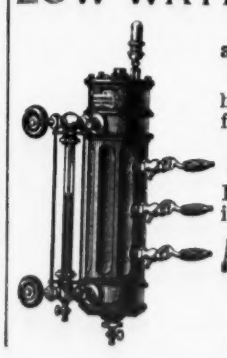

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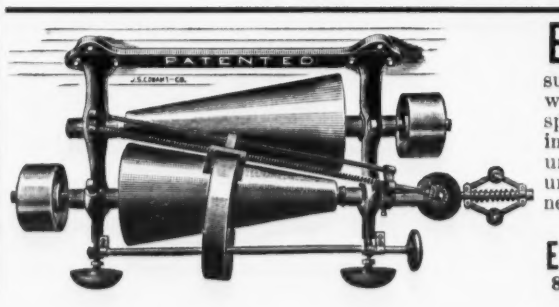

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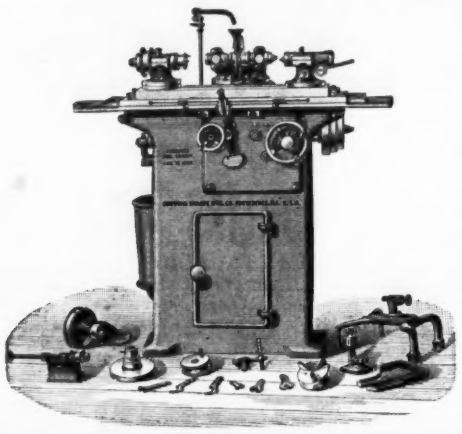

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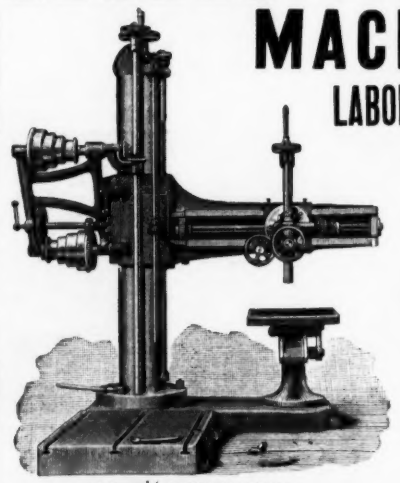

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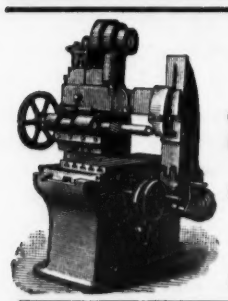

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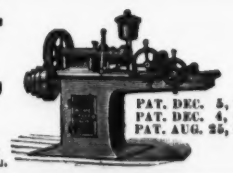

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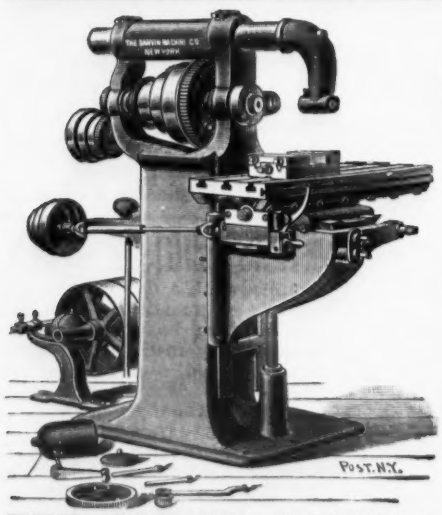

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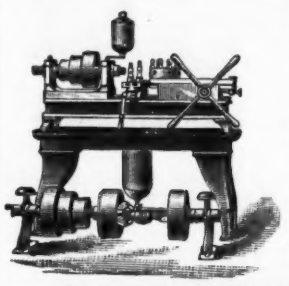

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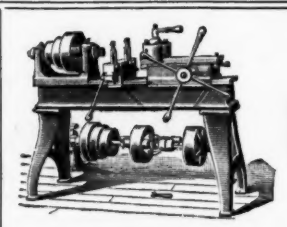

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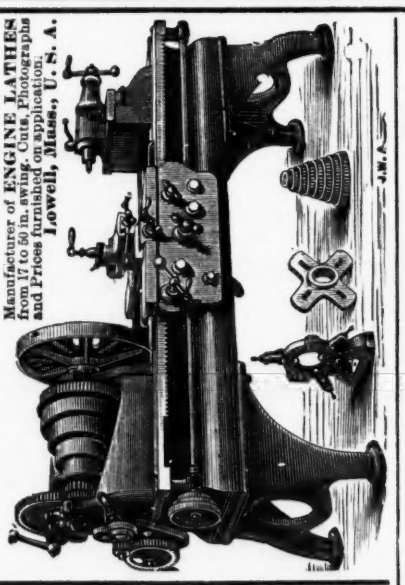

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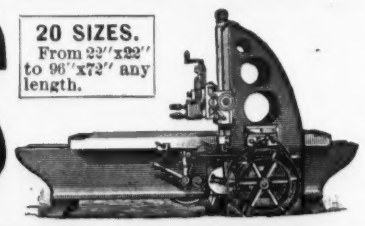

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